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ABSTRACT

Padilla Bay National Estuarine Research Reserve in Washington is managed by the Washington State Department of Ecology, Shorelands and Coastal Zone management Program. This guide is designed for primary teachers to complement a visit to the reserve and is a useful resource to teach about estuaries, shorelands, and coastal resources. Activities are divided into four sections. In the first section, five pre-trip activities introduce students to estuaries, describe different habitats within the estuary, familiarize students with birds found in estuaries, and have students observe differences between fresh and salt water habitats. On-site materials in the second section include information to parents, a map of the park, a scavenger hunt, and beach etiquette. The third section includes 22 post-trip activities involving plant and animal life in the estuary. A resources section contains lists of 11 children's books, 2 magazines, 7 reference books, 5 related curricula, 7 additional places to visit, 2 organizations, and a road map. (MDH)

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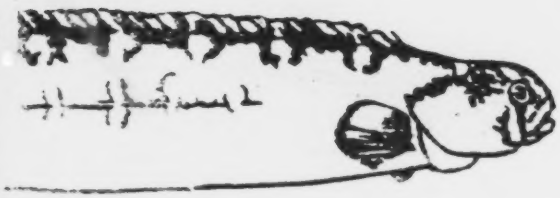
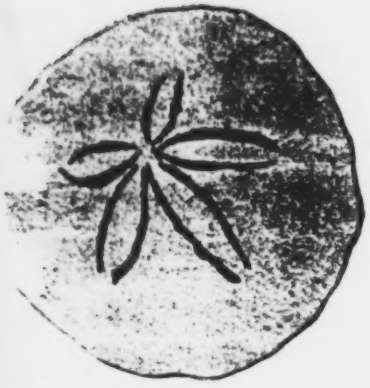
ED 370 803

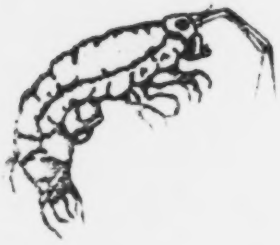
Padilla Bay

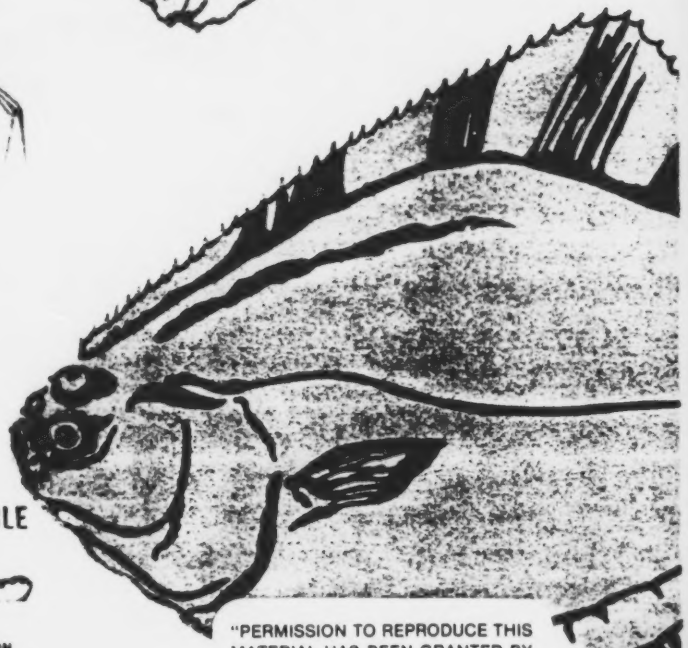
THE ESTUARY GUIDE

LEVEL 1









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Padilla Bay National
Estuarine Research Reserve
Breazeale Interpretive Center

THE ESTUARY GUIDE

LEVEL 1

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Welcome to Padilla Bay!

We are a National Estuarine Research Reserve, one of 21 in the country and the only one in Washington State. We are set up as a natural field laboratory for studying and teaching about the importance of wetlands and shorelands: estuaries in particular.

Concern for these areas has been growing along with both an increasing awareness of their value and of the abuses we have carelessly inflicted upon them. It is only in the past few decades that we are realizing the richness in our own backyards.

There is a wealth of beauty, humor and truths stranger-than-fiction out there waiting to be understood. May these beginning activities lead to a closer bonding between the student of any age and the natural world.

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Introduction

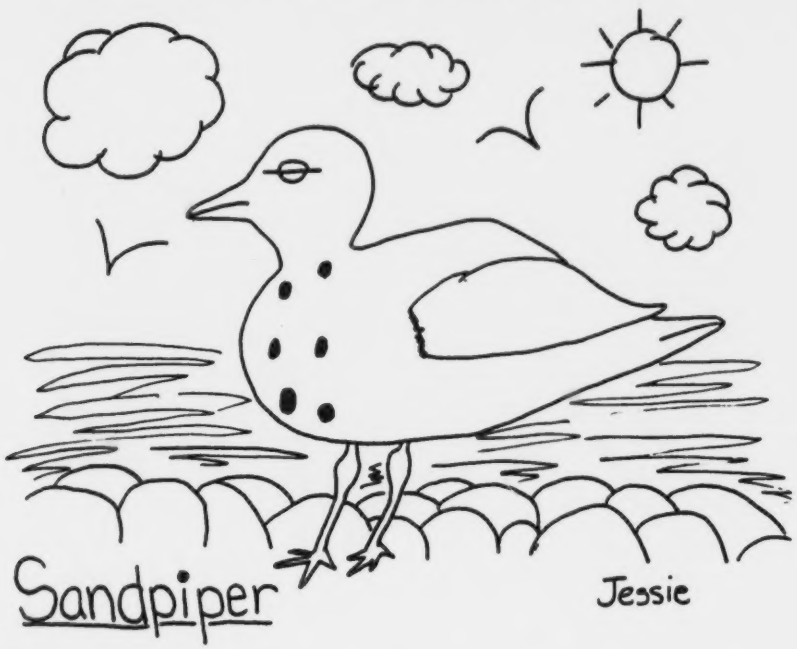
The Estuary Program - Level 1

This guide is designed for use by teachers of primary grades to complement a visit to the Padilla Bay National Estuarine Research Reserve. It is also a useful resource to anyone teaching about estuaries, shorelands, and coastal resources.

It is divided into four sections:

- PRE-TRIP information and activities
- ON-SITE materials and PARENT PAGES
- POST-TRIP ideas
- RESOURCES

A variety of activities is included, designed to weave together many subjects and many ways of learning. Our hope is that some will fit comfortably into your classwork and with your unique style of teaching. As there is a considerable span of grade levels covered in this guide, not all ideas will be applicable for your class. Please use and adapt the activities as you see fit.



Introduction

Teacher Checklist

Pre trip:

____ Read through this curriculum packet.
____ Arrange for adequate adult supervision. (We suggest one adult for every 5-8 children.
____ Prepare adult leaders by sharing with them the appropriate Parents' Pages (pp. 32-33).
____ Make legible name tags for all.
____ Consider using one or more of the pre-trip activities on pp. 7-28.

On Site:

____ Are your children wearing name tags?
____ Please arrive at your scheduled time or call to let us know of a change.
____ Enjoy!

Post trip:

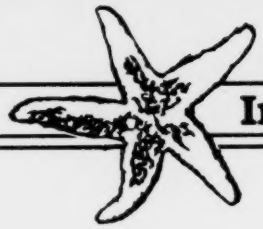
____ Continue the estuary studies back in your classroom with some of the many activities listed on pp. 39-79 of this curriculum.
____ If you have suggestions for any improvements or changes we could make to our program, please write or call (206)428-1558.
____ Our programs are supported by State and Federal funds as well as The Padilla Bay Foundation. Your comments on continued funding and/or the quality of our programs may be sent to:

Director
Washington State Department of Ecology
PO Box 47600
Olympia, WA 98504

____ You may also consider making a donation to or joining:

The Padilla Bay Foundation
PO Box 1305
Mount Vernon, WA 98273

Note:
If you will be combining your visit with a trip to the beach at Bayview State Park, be sure to read through "At the Beach" on pp. 34-38



Introduction

A Bit About Estuaries. . .

The Skagit River begins in the North Cascades. It tumbles down mountainsides, spills over waterfalls, runs past towns and under bridges, winds through the fertile Skagit Valley and eventually slows down as it nears its estuary, the Skagit Delta. An estuary: the place where a river meets the sea.

Estuaries are remarkable places, rich with treasures hidden from the casual observer. Life is concentrated here. The amount of plant material produced in an estuary far exceeds that of even our best-tended wheat fields. In turn, plants provide food and shelter for a myriad of animals. The bay is a veritable garden.

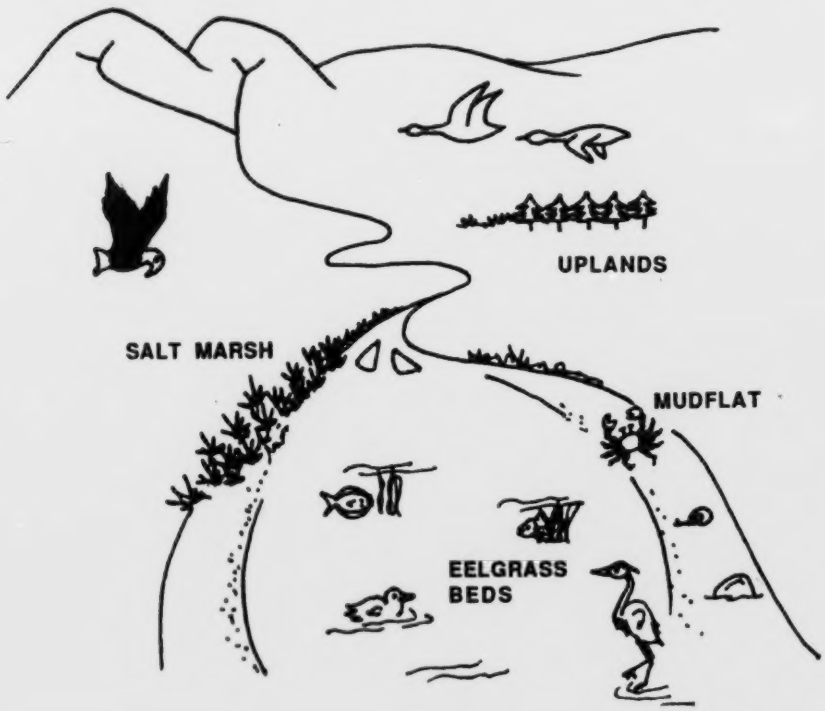
Plants

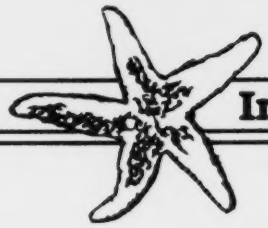
The complex marine food web begins with phytoplankton, the tiny, free-floating plants that thrive in the shallow, sunlit, nutrient-rich waters. Phytoplankton belong to a group of plants called "algae." Larger algae are commonly called seaweeds. Another producer is eelgrass (one of the few true flowering marine plants) which carpets Padilla Bay and gives the bay its unique character. It offers food and shelter to the many animals that live on and among its blades. Eelgrass is food for many animals, but is perhaps more valuable once it has died and decayed. Broken down by bacteria, these bits of detritus add nutrients to the system. A third major group of plants consists of the salt marsh plants that form the transition zone between land and water. These specialized plants add nutrients to the bay, filter out toxins from land run-off, and soak up excess rain water like a sponge.

Introduction

Animals

The abundant plant life in an estuary attracts an endless variety of animals, for it provides ample food and shelter. An estuary can be a home, a nursery or a rest stop for migrating animals. An oyster, for example, spends its entire life in an estuary. It begins life as a zooplankter and settles down as it matures. Salmon need to spend time in an estuary on their journey to the sea. The bay provides food to grow on as well as a gentle transition stage from the fresh water to the salt. Many other marine animals use the estuary as a nursery for raising their young. Juvenile Dungeness crab, herring, perch, and flounder are found in large numbers in the shallow waters of an estuary. Padilla Bay, like many estuaries, is located on a major flyway and hosts scores of migrating waterfowl. Some choose to winter here while others continue southward. Many marine animals, including most commercial seafood species, are in some way connected to the richness in an estuary.





Introduction

"Estuary" comes from the Latin word "aestus," meaning "tides." Twice a day the tides fill and empty the bay. The seasonal cycles and daily fluctuations of tides, salinity and temperature create a unique environment that requires special adaptations of its inhabitants. Yet life forms are numerous and productive, attesting to the natural wealth in an estuary.

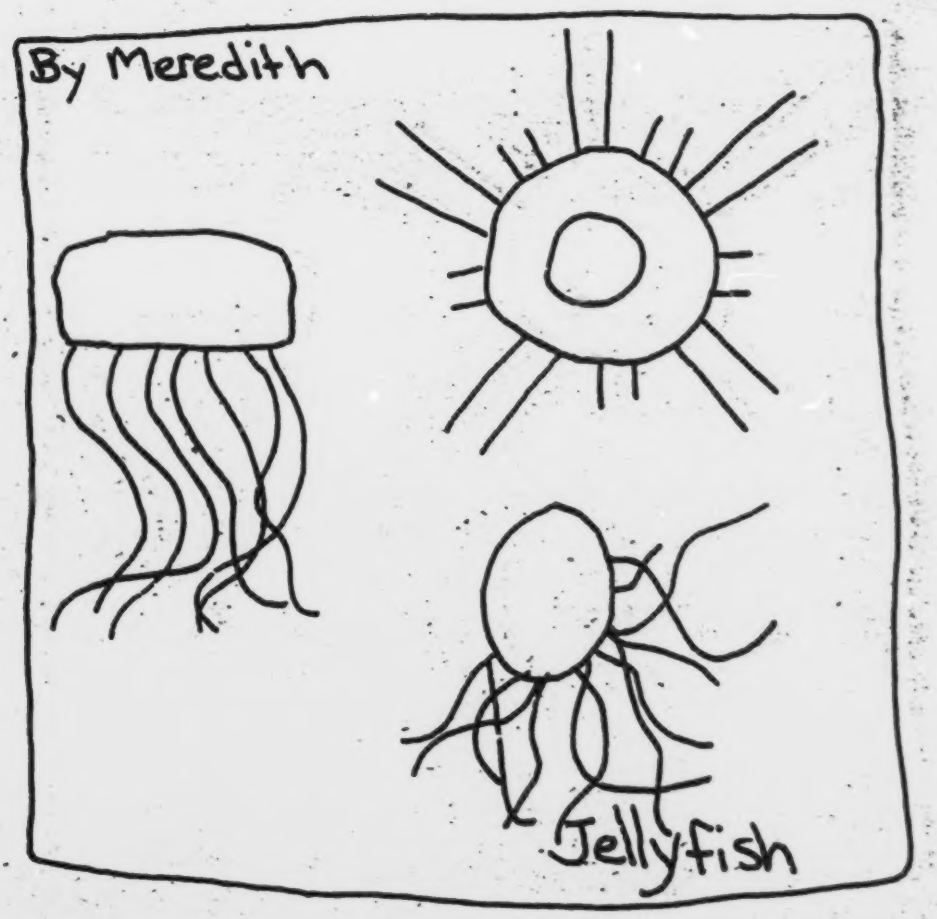
People

People are no exception. We, too, flock to estuaries for the natural resources; economic, edible, and aesthetic. The scenic backdrop for recreational activities and the peace and beauty at the water's edge lures us. Many of the world's largest cities are built on estuaries. More than half of the US population resides near an estuary. In Washington State, over 3 million people live near the Puget Sound estuary and that number is increasing.

Growing appreciation is a mixed blessing, for the price of development is often a trade-off with the health of the environment. Estuaries have been used and much abused in the past. Seen as barren and muddy wastelands, they have been targeted sites for dredging, diking, dumping of wastes, and development. Chesapeake Bay is on the "critical" list. Over 75% of both San Francisco Bay and the Fraser River estuary have been filled in. The Skagit delta has lost about 95% of its wetlands.

Halting this trend takes scientific research and an educated, concerned public. In 1972, the federal government responded to the crisis by passing the Coastal Zone Management Act which includes the National Estuarine Research Reserve System.

We're glad that you are here to learn with us.


By Meredith
Jellyfish

Pre trip Activities

Introducing Your Class to Estuaries ..... p. 9
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Estuary Birds ..... p. 14
Vocabulary List and Word Games ..... p. 21
Salt Water - Fresh Water ..... p. 26

Introducing Your Class to Estuaries

- Lead a discussion. When introducing your class to estuaries, begin with the familiar. Ask about their experiences that may connect with estuaries.

  Do you live near a river or beach?

  Have you ever visited an estuary?*

  What have you seen or done there?

  What did it look like?

  What plants or animals did you see there?

  Do you ever go boating?

  Do you catch fish?

  Was the water fresh or salty? (Don't discount fresh water experiences.)

  If you live near a river or stream, find out where you would end up if you floated downriver in a boat.

- Read a story. Many good ones are listed on p. 83.

- Sing a song. Check the ones on pp. 72-78.

* Most of the groups that come to Padilla Bay live right by an estuary, though they may not realize it. Puget Sound is one very large estuary. That means that everyone near Puget Sound is near an estuary! Let your students know that an estuary is not necessarily some muddy, marshy, far away place. It may be right next door!

Where Is My Home?

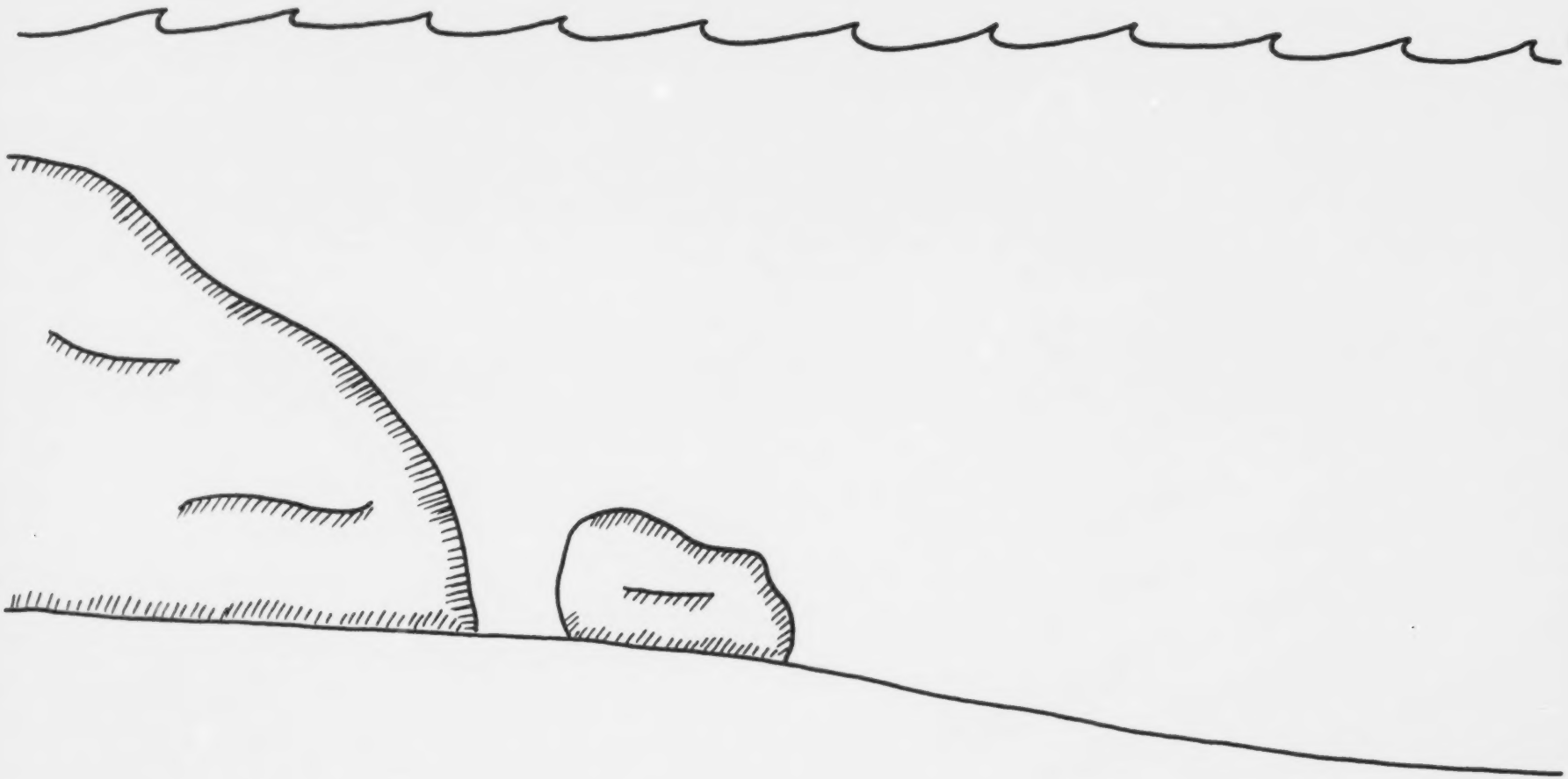
In this activity, students cut out estuary plants and animals and glue them onto the correct habitat.

Concepts: A *habitat* is a place where a plant or animal lives. Different plants and animals live in different habitats. Estuaries have many different habitats. This activity shows the rock, mud, and water habitats.

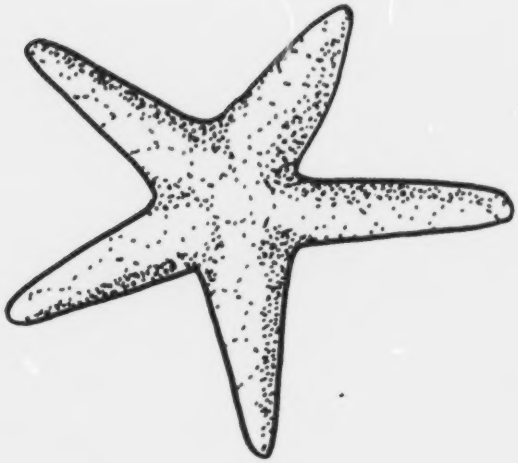
Discuss habitats with your students. Begin with familiar habitats such as a forest, pond, or backyard. What plants and animals live there? Why do they think different plants and animals live in different habitats? Imagine how silly a plant or animal would be in the wrong habitat.

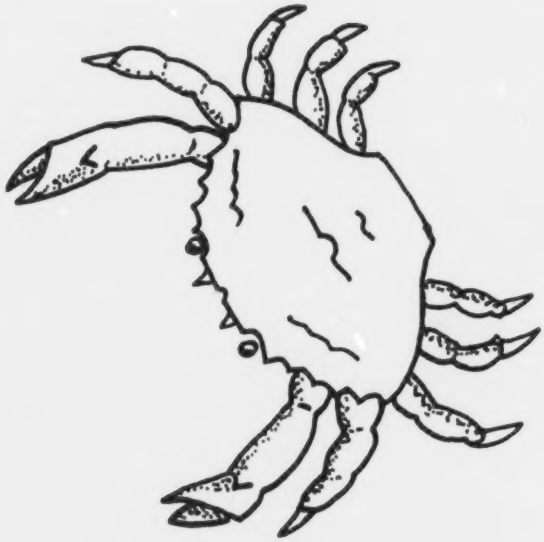
Talk about animals at the beach. What lives in the water? What lives on or under rocks? Could a barnacle live at a beach where there were no rocks? Make a list of possible estuary habitats.

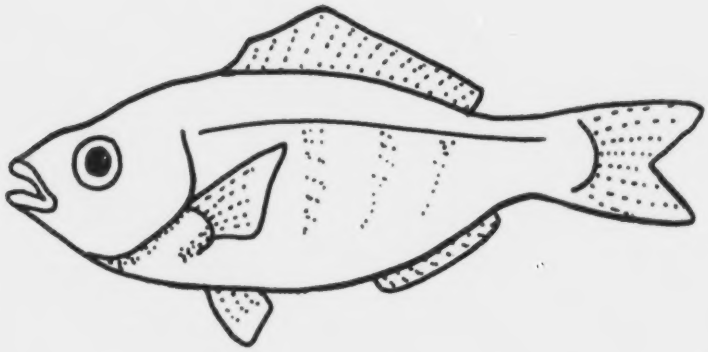
Color and cut out the estuary animals and glue them in the right habitat. There are two sets of animals included here. Choose the one appropriate for your students.

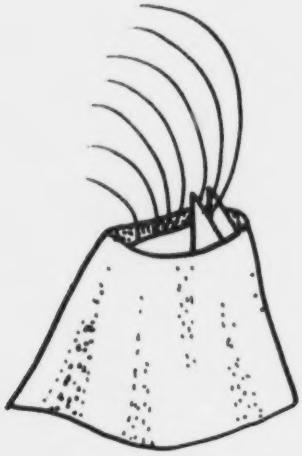


Where is my home?

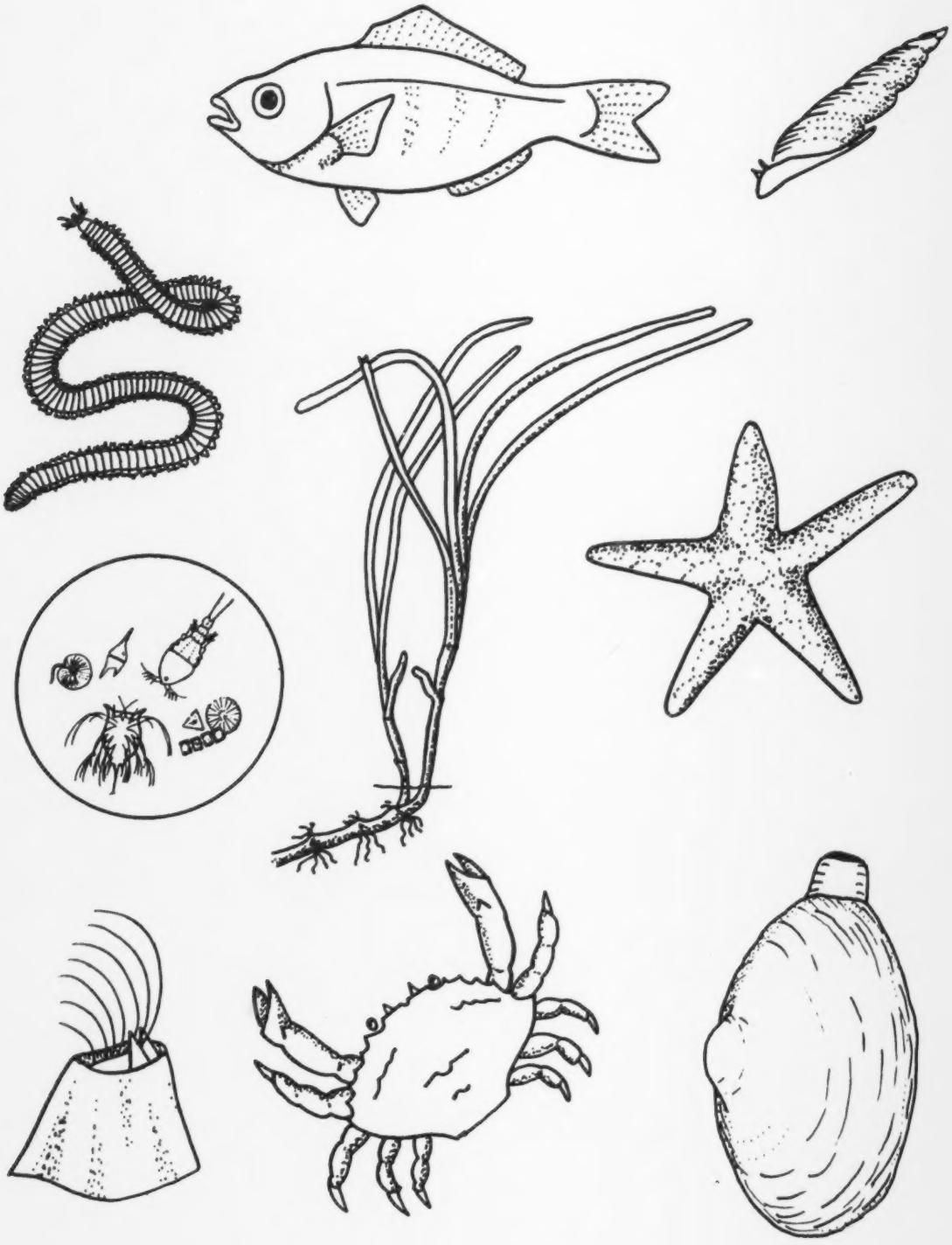








Where is my home?



Estuary Birds

In this activity, students become familiar with different kinds of birds that can be found in estuaries like Padilla Bay -- birds they are likely to see on their field trip. They color the Estuary Birds page and may add more birds (and themselves), if they like.

Concepts: Many birds use estuaries for protection and food. Each is very specialized with adaptations for its particular environment and food preference. Birds' beaks, feet, body shape, etc., tell us about how they live.

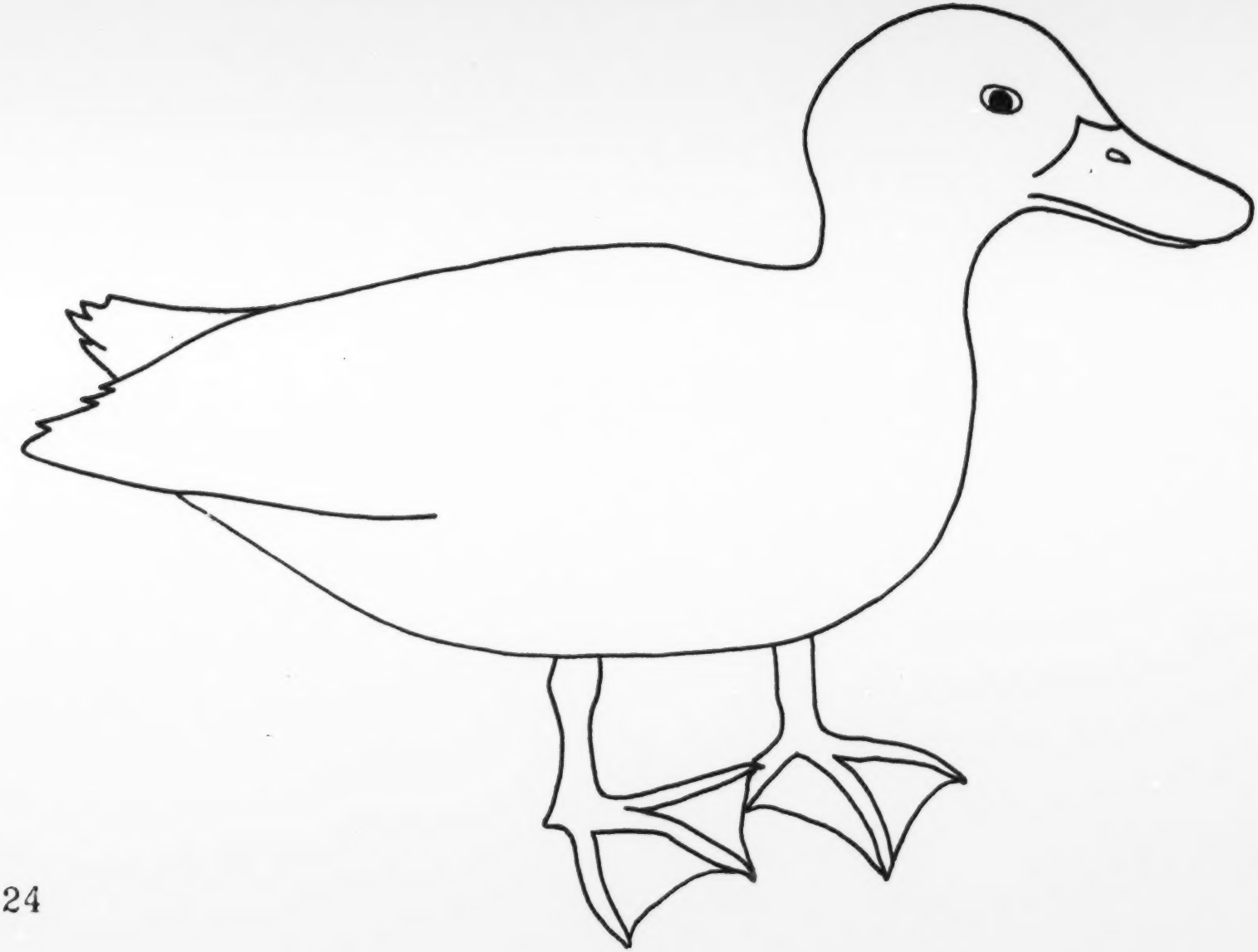
Tape or pin the four bird drawings in front of the class. Talk about the differences. Guess where you might see them and what they might eat. Talk about specific adaptations such as long legs, sharp talons, webbed feet, long beaks, and curved beaks. Why would these adaptations be useful? Can they name the birds? Have students color the *Estuary Birds* page and add other birds they think they may see. The following information may be useful in your discussion.

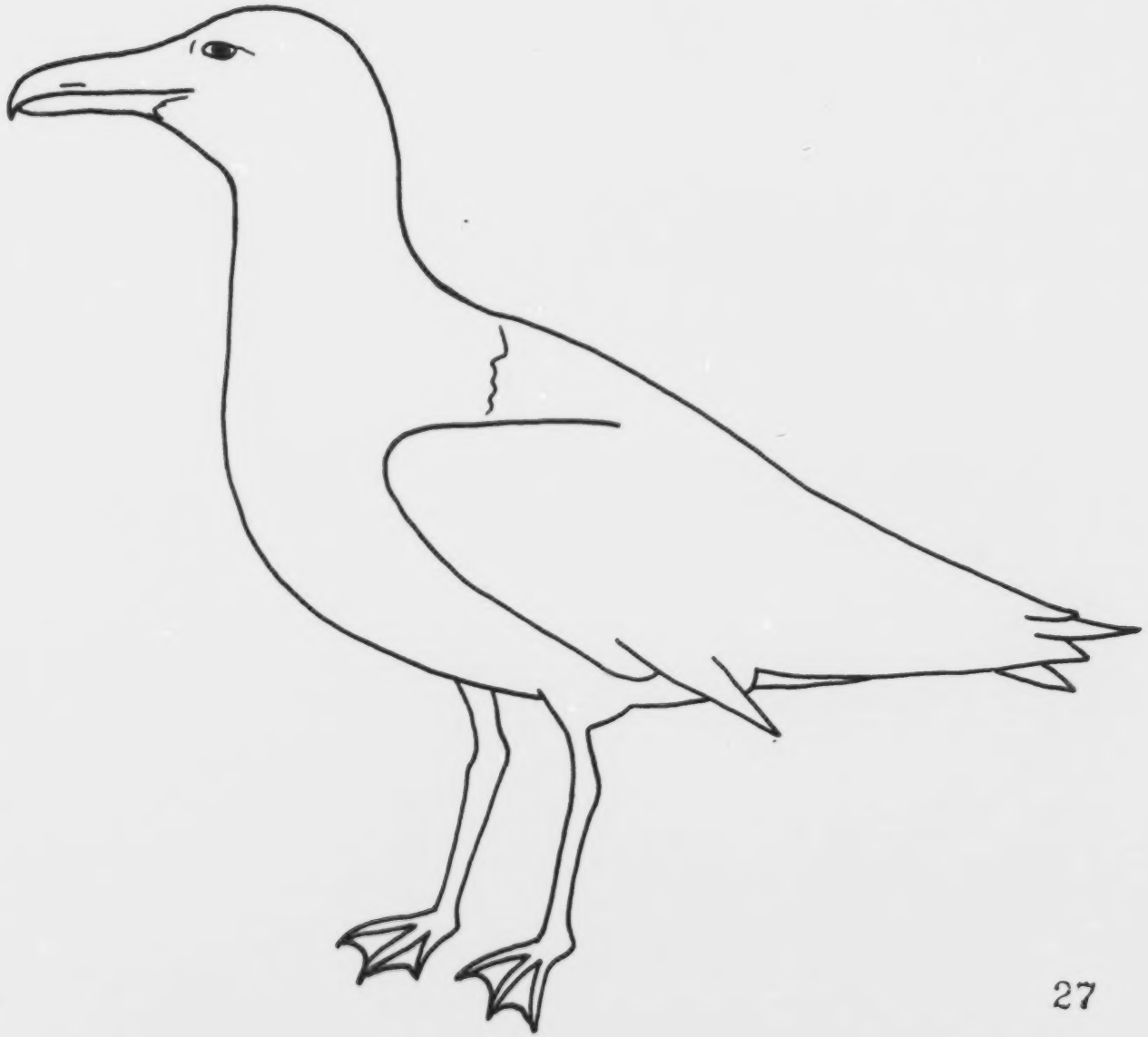
Eagles are one of the largest birds in North America. They are often seen perched in tree tops or soaring with wings outspread. They eat fish like salmon and ducks. Adults get their characteristic white head and tail at 4-5 years of age. Immature birds appear dark.

Great Blue Herons stand 3-4 feet tall. They fly with a slow wingbeat and legs stretched out behind them. When flying and often while standing, they fold their long neck up into an "S" shape.They will stand almost motionless in the water when hunting for a meal of fish or crab.

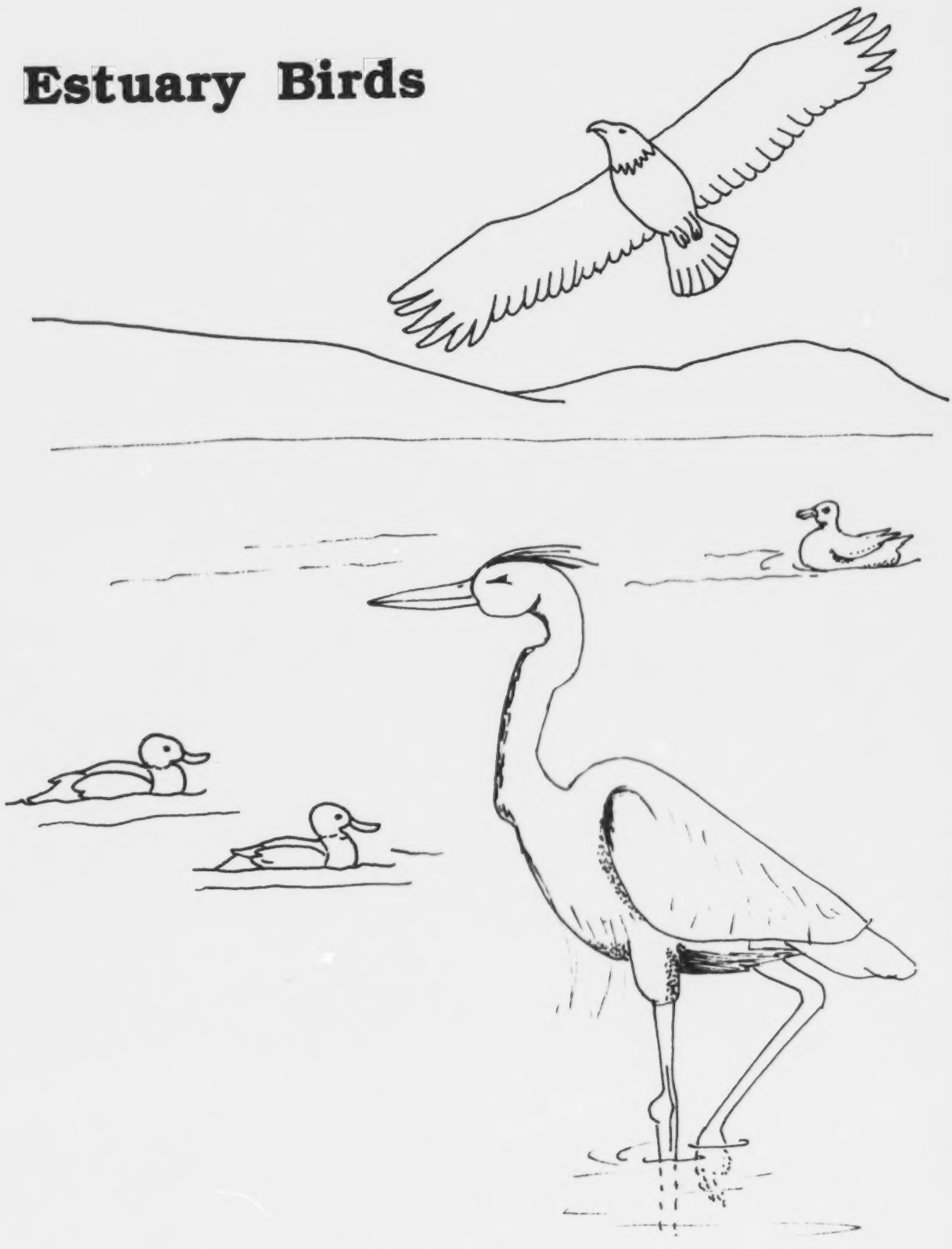
Ducks are here by the thousands from October through April. Places like Padilla Bay are their wintering grounds. Their rapid wingbeats can often be heard when they fly overhead. There are many different kinds of ducks. Some eat plant matter, some eat fishes and some dive for clams and crabs on the estuary floor.

Gulls are well known to most of us. These striking grey and white birds frequent shores, the open ocean, inland waters and garbage dumps! Though they often scavenge dead things or garbage, you may observe a gull cracking open a clam shell by dropping it onto a rock below. Young gulls look dirty grey.





Estuary Birds



Vocabulary

estuary: a place where fresh water mixes with salty sea water. All of Puget Sound is an estuary.

fresh water: water without salt in it. *Fresh* water may be *dirty*.

salt water: water with salt dissolved in it.

habitat: the place where a plant or animal lives.

tides: the rise and fall of ocean water twice a day.

plankton: plants or animals floating in the water -- usually microscopic.

phytoplankton: plants floating in the water.

zooplankton (ZOE-plank-ton): animals floating in the water.

microscopic: something too small to see without a microscope.

detritus: (dee-TRY-tis): rotting bits of plants and animals.

energy: strength to move and grow.

filter feeder: an animal, such as a clam or oyster, that strains food from the water.

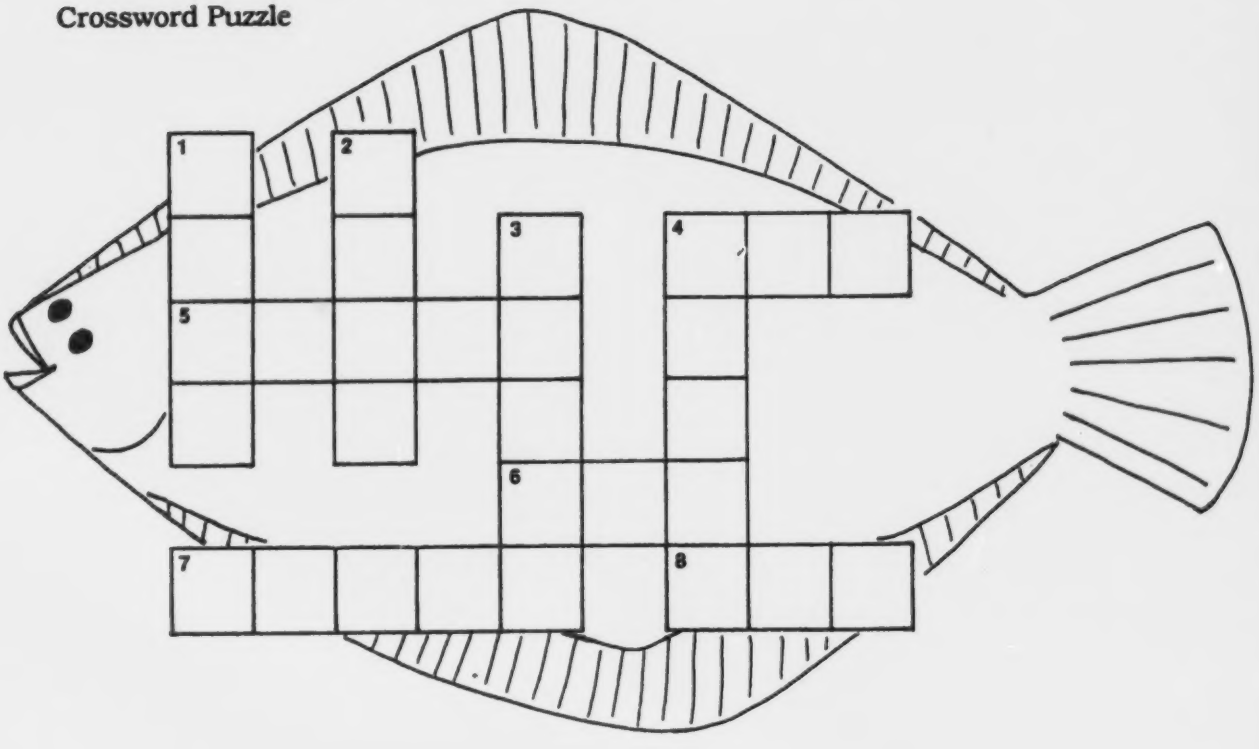
food chain: a sequence or "chain" of living things in a community, based on what eats what: for example, gull eats clam and clam eats plankton.

food web: overlapping and connecting food chains.

migration: seasonal movement of an animal from one place to another.

Who Am I?

Crossword Puzzle



Clues

Across:

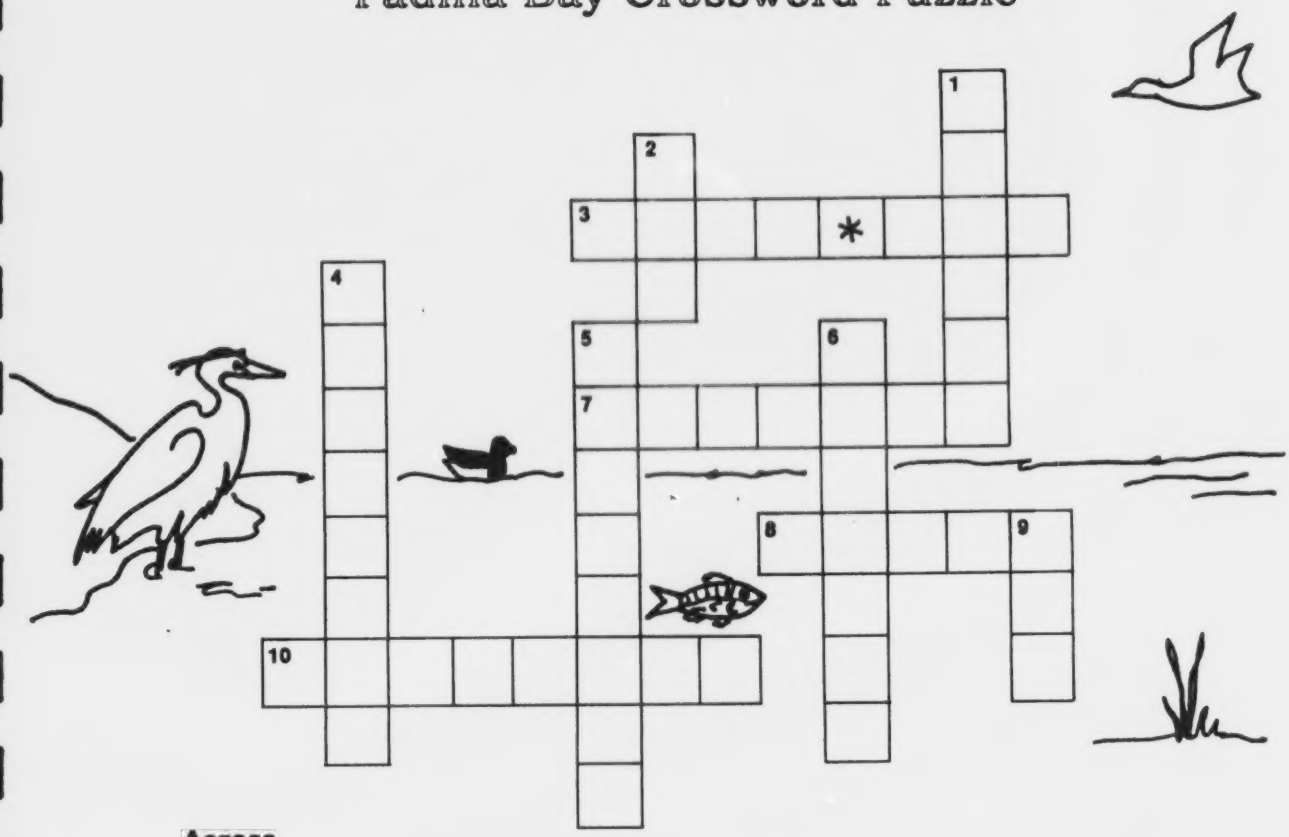
4. I am a watery place where many plants and animals live.
5. I move VERY s-l-o-w-l-y.
6. I am home for clams and worms.
7. We go up and down in the bay twice every day.
8. I shine and give energy to all the plants.

Down:

1. I swim in the water.
2. I have 2 big claws and many legs.
3. We have 2 shells and live under the mud.
4. We fly to the bay to look for food.

Words to Use
bay
birds
clams
crab
fish
mud
snail
sun
tides

Padilla Bay Crossword Puzzle



Across

3. Many food chains connect to make a ___ ___.
7. The place where a river meets the sea.
8. The rise and fall of ocean water twice a day.
10. Floating plants and animals.

Down

1. We eat food to get ___ to grow.
2. Floating animals are called ___-plankton.
4. An animal that attaches to rocks and eats plankton.
5. Rotting bits of plants and animals.
6. The place where an animal lives.
9. The salt water in an estuary flows in from the ___.

Use these Words

barnacle
detritus
energy
estuary
food web
habitat
plankton
sea
tides
zoo-

Word Search

In the puzzle below, look for the vocabulary words listed. Then do the matching exercises.

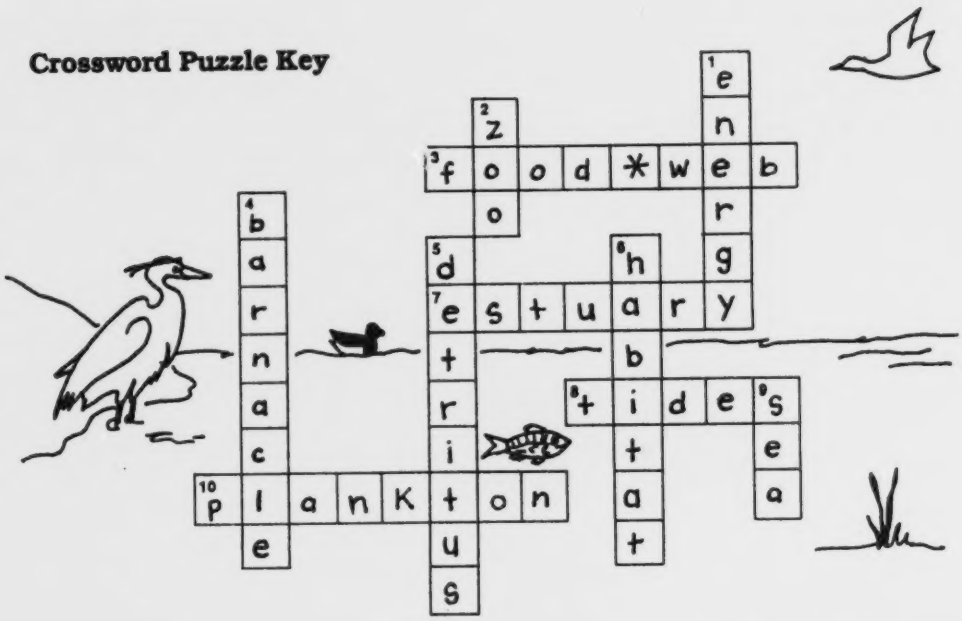
M L F E S T Z B X E C T E A P
I Y T O E R U E S I M B I L H
G T S E O N K C P E N E R G Y
R S R S T D I O S T A W I R T
A E R T S U C H A G P D Q U O
T R G U K S X H F I R O T S P
I S W A O C B T A Y U O N K L
O O T R S C F T Z I L F X V A
N A C Y Z O O P L A N K T O N
I I C T R Y T S P E E A P T K
M I C R S E E R E C T E P Z T
H A B I T D E T R I T U S X O
S U T R I F E C B Z Y S E W N
T Z U T O P L A N K T O N W P
H I T R W M H E L G J B Y I X

Put the letter of the correct definition in the space by the word.

___ 1. plankton
___ 2. food chain
___ 3. habitat
___ 4. estuary
___ 5. microscopic
___ 6. tides
___ 7. zooplankton
___ 8. migration
___ 9. food web
___ 10. energy
___ 11. phytoplankton
___ 12. detritus

A. A place where fresh water mixes with salt water
B. Rotting bits of plants and animals
C. What eats what in a community
D. When a group of animals moves from one place to another
E. Plants and animals that float freely in the water
F. Overlapping and connecting food chains
G. The place where a plant or animal lives.
H. Something too small to see without a microscope
I. Strength to move and grow
J. The rise and fall of ocean water twice a day
K. Animals floating in the water
L. Plants floating in the water

Crossword Puzzle Key



Word Search Key

M	L	F	E	S	T	Z	B	X	E	C	T	E	A	P
I	Y	T	O	E	R	U	E	S	I	M	B	I	L	H
G	T	S	E	O	N	K	C	P	E	N	E	R	G	Y
R	S	R	S	T	D	I	O	S	T	A	W	I	R	T
A	E	R	T	S	U	C	H	A	G	P	D	Q	U	O
T	R	G	U	K	S	X	H	F	I	R	O	T	S	P
I	S	W	A	O	C	B	T	A	Y	U	O	N	K	L
O	O	T	R	S	C	F	T	Z	I	L	F	X	V	A
N	A	C	Y	Z	O	O	P	L	A	N	K	T	O	N
I	I	C	T	R	Y	T	S	P	E	E	A	P	T	K
M	I	C	R	S	E	E	R	E	C	T	E	P	Z	T
H	A	B	I	T	D	E	T	R	I	T	U	S	X	O
S	U	T	R	I	F	E	C	B	Z	Y	S	E	W	N
T	Z	U	T	O	P	L	A	N	K	T	O	N	W	P
H	I	T	R	W	M	H	E	L	G	J	B	Y	I	X

E 1. plankton

C 2. food chain

G 3. habitat

A 4. estuary

H 5. microscopic

J 6. tides

K 7. zooplankton

D 8. migration

F 9. food web

I 10. energy

L 11. phytoplankton

B 12. detritus

Pre-trip

Salt Water -- Fresh Water

Students observe the difference between salt and fresh water and discuss how plants and animals live in one or the other.

Talk about salt water and fresh water. Fresh water is water without salt in it, not necessarily *clean* water.

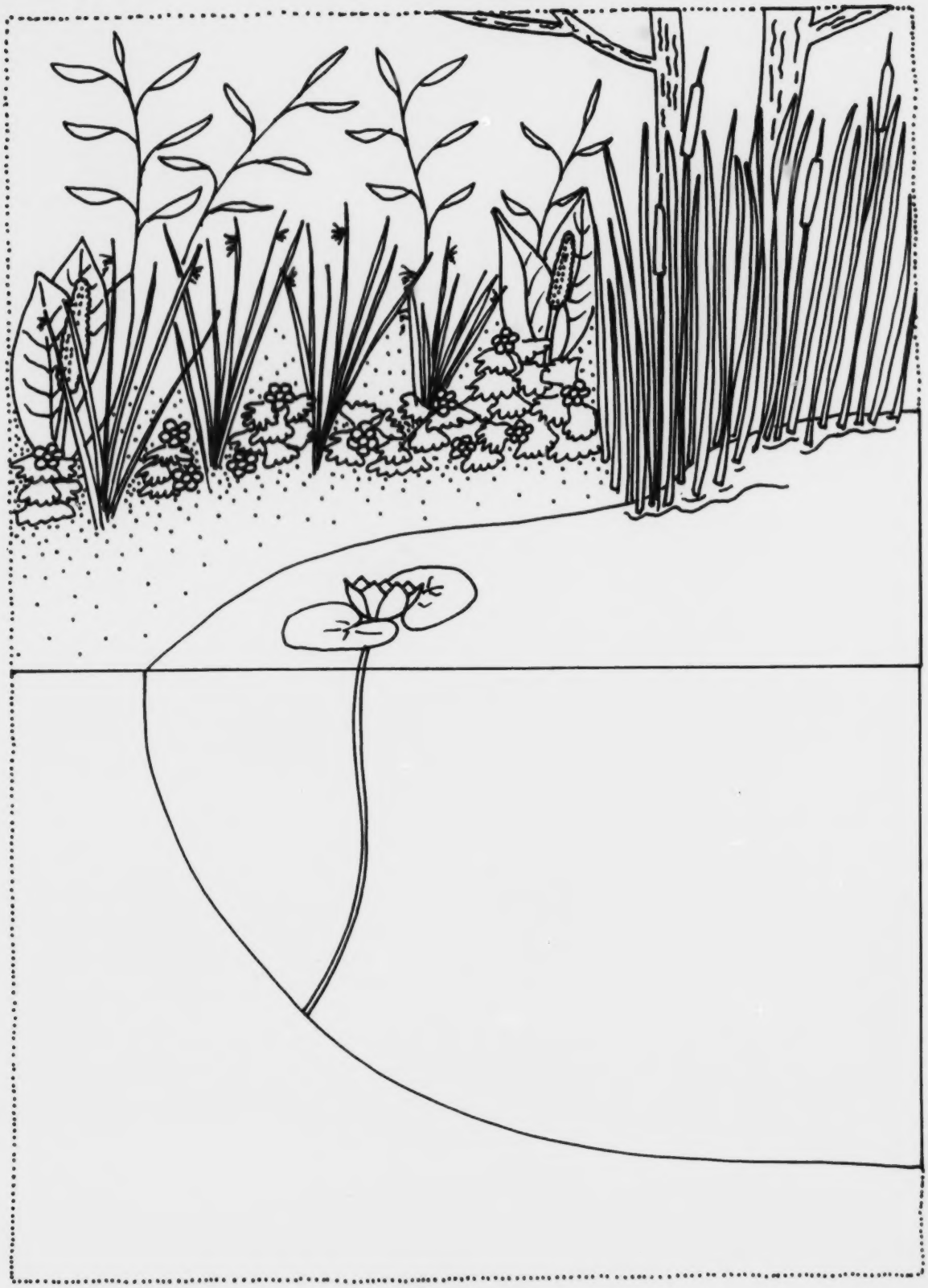
Let your students observe tap water. They can look at it, smell it, taste it. Then let them make salt water by adding 1 teaspoon of salt to 1 cup of fresh water (the approximate amount in ocean water). If the salt is dissolved, the two should look and smell the same.

Place a small amount of salt water (maybe collected from a nearby beach) in a shallow dish. Let the water evaporate and observe the salt crystals left behind. Even though we can't see dissolved salt, we know it's there!

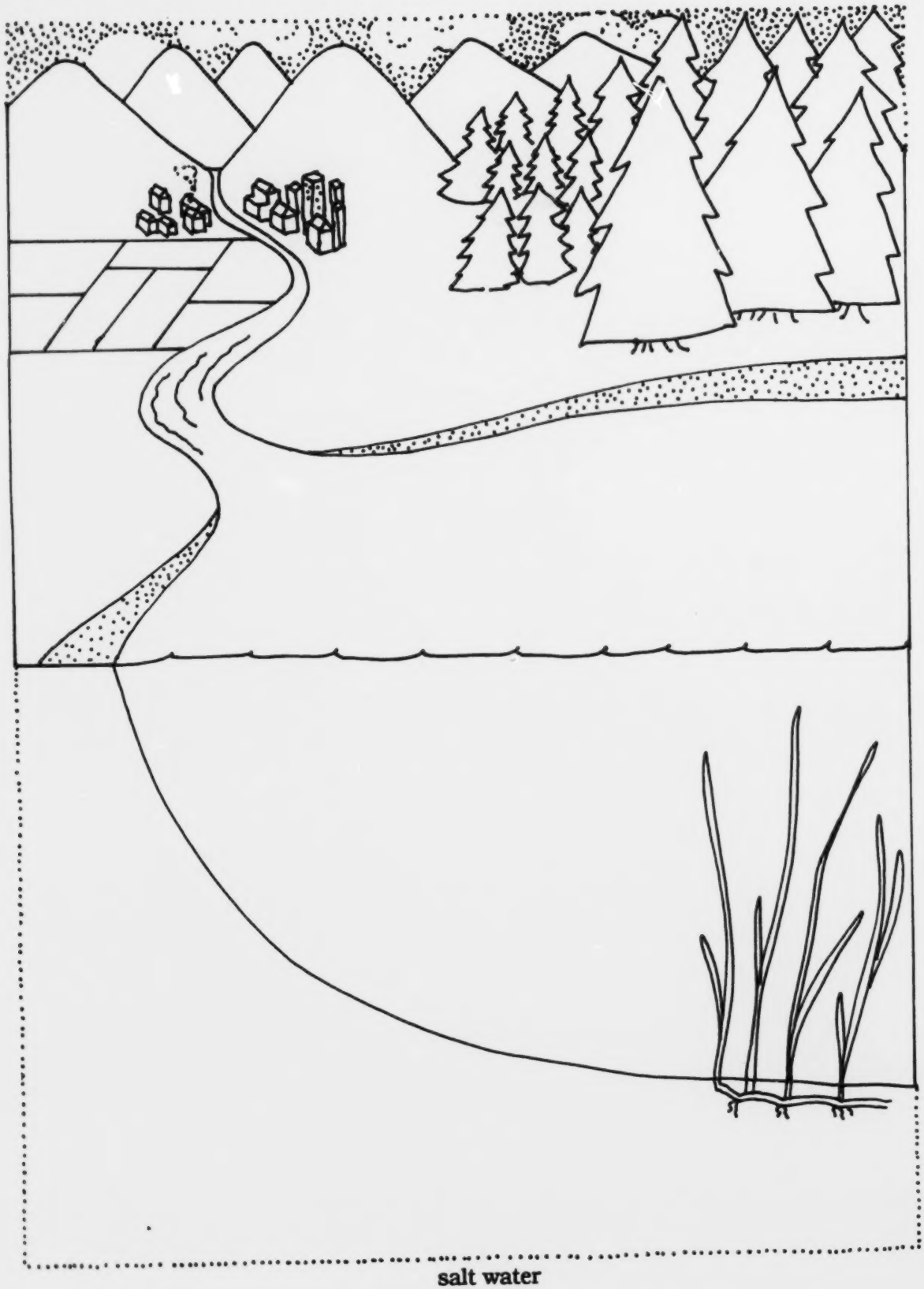
Make two lists on the board: one of plants and animals that your students think might live in fresh water and one of plants and animals that might live in salt water. Can they think of any that live in both? Most plants and animals are specially adapted to live in either salt water or fresh water, seldom both.

Copy the two wetland habitat pictures and let your students draw and color in animals in their appropriate home. Here's a list to get them started:

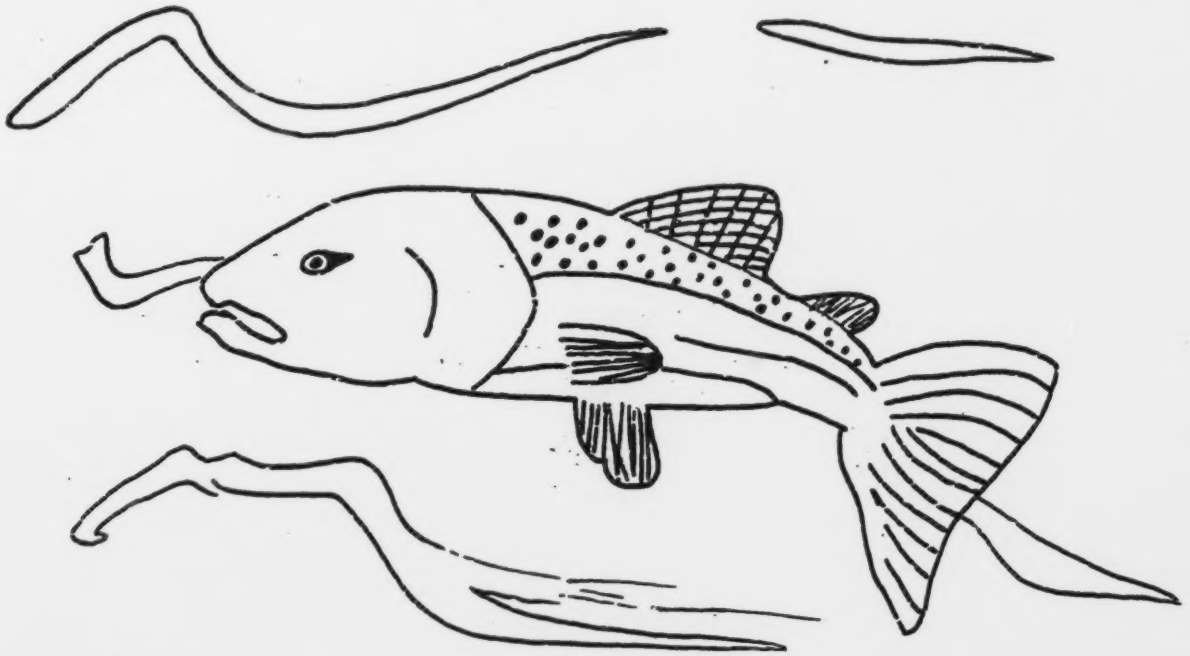
Freshwater wetland	**Saltwater wetland (estuary)**
cattails	algae
duckweed	eelgrass
water lily	saltgrass
skunk cabbage	crab
fish	snail
frog (and tadpoles)	worm
salamander	clam
turtle	shrimp
snake	fish
dragonfly	seastar
crayfish	hermit crab
snail	great blue heron
great blue heron	



fresh water



salt water



ANTHONY

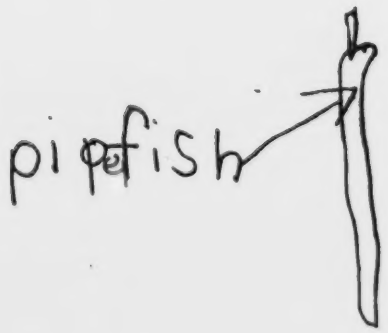
On-site Materials

Introduction ..... p. 31
Parent Pages ..... p. 32
At the Beach ..... p. 34
Map of Bay View State Park ..... p. 35
Beach Etiquette ..... p. 36
Scavenger Hunts ..... p. 37

We will welcome your class at the Interpretive Center entrance. A presentation in the theater will introduce the world of the estuary through stories, creative dramatics and film. Your group will then tour the interpretive exhibits. A static display depicts plants and animals found in Padilla Bay's many varIED habitats. The Hands On Room offers games, puzzles, books, puppets, and estuary treasures for touching. The Aquarium Room contains saltwater aquaria with live animals and plants from the Bay.

Many teachers choose to follow up the Padilla Bay visit with a trip to the beach at Bayview State Park. On pages 34-38, we have included some suggestions and resources that may be useful to you.

Please be sure to share the appropriate Parents' Pages with adult volunteers. They will be in charge of their group during the exhibit tour. We believe that students benefit more from this field trip when leaders have guidelines and suggestions for focusing the group's attention.



by Brandi Carlson

On-site

Parent Page

Thank you for joining us today. This program could not happen without you. We especially need your help when the children are touring the interpretive exhibits.

You will be in charge of a group of students. Please keep them together and focused. The following is a guide to help you focus the attention of your group Please use it as you see fit. The more you get involved, the more your group will follow suit.

Aquarium Room

1. Many fish are CAMOUFLAGED. Look for a fish that resembles eelgrass (pipefish) and one that looks like the sand (flounder).

2. Other animals HIDE. Are any squeezed between rocks or burried under the sand?

3. How many animals can you find that have hard SHELLS on the outside of their bodies? How does this help them survive?

4. Name 3 differences between you and a fish.

5. What is your favorite animal in the aquaria and why?

Main Exhibit Room

1. How many animals walk on 2 legs? 4 legs? fly? swim?

2. Which birds have webbed feet? Which have talons? What do they use their feet for?

3. Which animal is the biggest? Which is smallest?

4. What is your favorite animal and why? Where does it live?

Hands-On Room

Though this room needs less direction, please supervise behavior and remind children to be gentle with the exhibits.

Parent Page

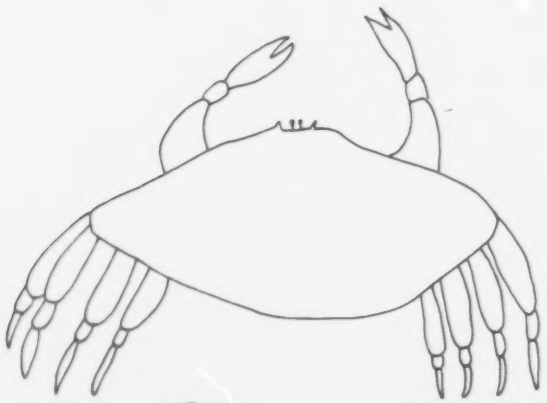
Exploring the Beach

You say you don't know the name of that crab? What in the world is that slimy green thing? You're not a marine biologist? Don't worry! Knowing everything at the beach is not what this trip is about. It's about sharing your enthusiasm, watching the excitement of children, and exploring with them.

When your group brings something to you and asks, "What is this?" the name is not important. In fact, giving the name may just turn off attention. Rather than answering children's questions, you'll find it much more interesting to return a question. "Where did you find it? What do you think those feathery things are? Do you think it's alive? Which is the front? Does it have a head? Shall we give it a name?" Open-ended, stimulating questions involve the children and encourage discovery.

Ouch! Ouch! Be the voice of the plants and animals when students, in their eagerness, get careless. Try to impart an ethic of care and responsibility. Be sure that students leave everything they find at the beach. Help by picking up any garbage you may find. Your example is very important!

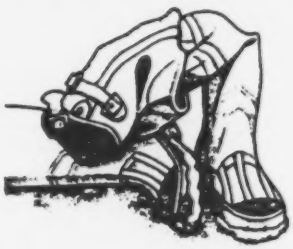
Please help us keep the State Park facilities clean by checking restrooms and picnic shelter for litter.



At the Beach

Be prepared! Warm clothing (hats), rain gear, snug boots or old shoes that tie, a change of clothing, and a hearty lunch will help ensure that your class enjoys the day in spite of cool or rainy weather. Check the school's lost and found for items you could borrow for the day.

Study the map of Bay View State Park and, if possible, visit the site ahead of time. Notice restrooms, telephone, and faucet for cleanup.



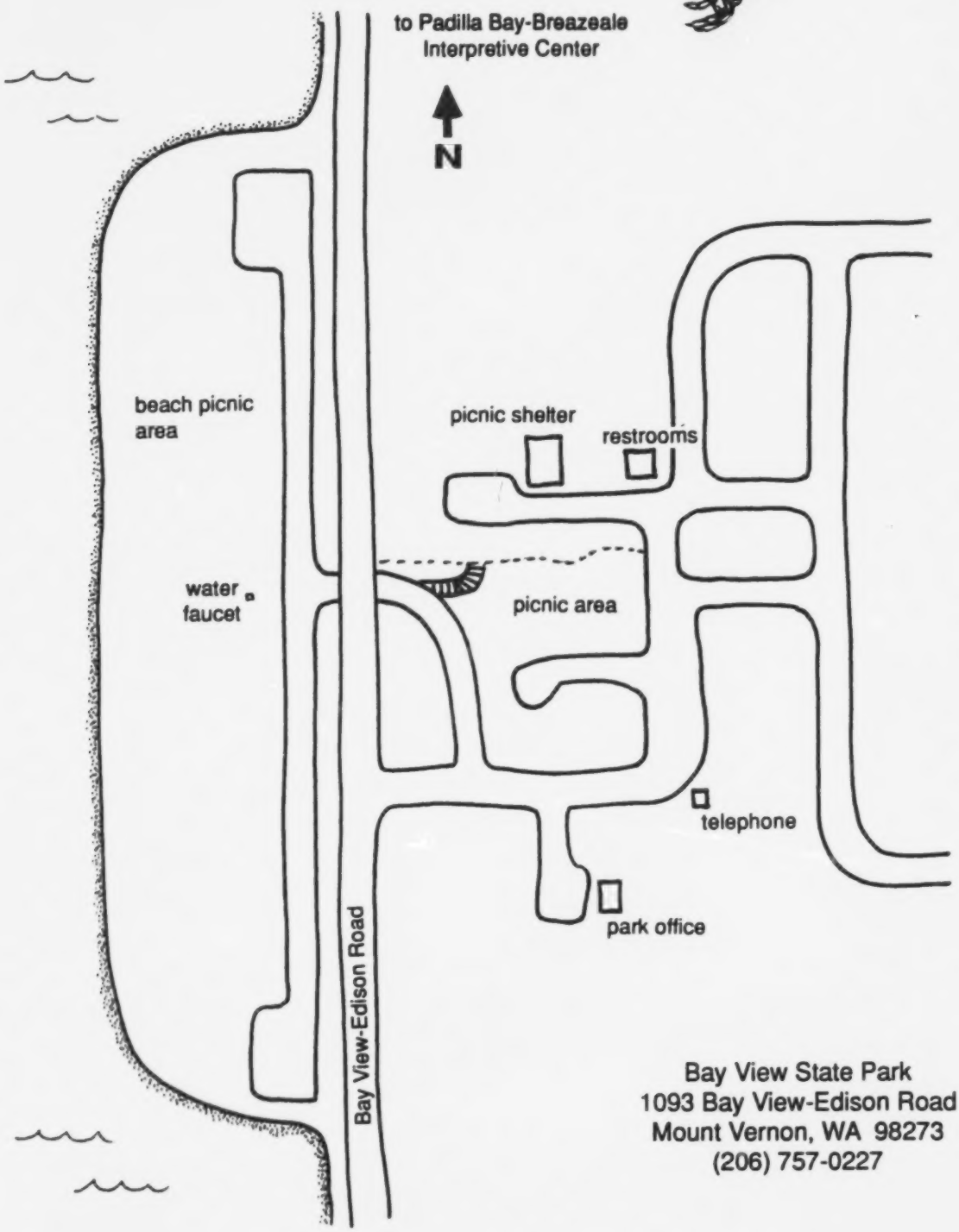
We find the following equipment useful when exploring the mudflat (one set for 5 - 8 people):

shovel (if tide is lower than +4')
tray (plastic dissecting trays or styrofoam meat trays - please don't leave these behind!)
clear plastic jar or cup for keeping animals in water
plastic spoons for picking up small creatures - or use a clamshell
hose and/or dishpans for clean up

Though not absolutely necessary, we have found that giving the children equipment helps them observe organisms closely and carefully, and sets an atmosphere of study rather than play.

We have provided several Scavenger Hunts to help children focus their attention on observation. Choose one that fits your goals for the field trip, or create your own. Be sure to set physical boundaries for the exploration, and emphasize that *all creatures and shells must be returned to the beach.*

On-site



Bay View State Park
1093 Bay View-Edison Road
Mount Vernon, WA 98273
(206) 757-0227

Beach Etiquette

Estuaries are valuable habitats -- homes for many organisms, some of them fragile. Please discuss with your class the ways to be careful with this important resource.

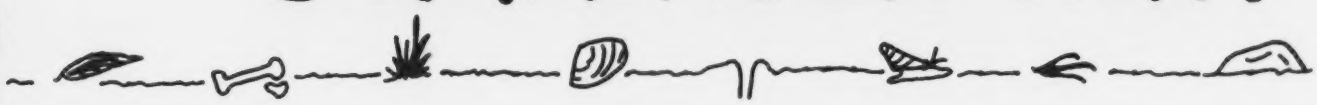
A technique we use here at the Padilla Bay Interpretive Center is called the **Magic Bag**. Children reach into a bag for objects that remind us of ways to be careful and respectful. A rock with a barnacle shell attached reminds us to return rocks to their original position. A toy shovel reminds us to fill in holes. A limpet shell sparks a discussion on adaptations to avoid drying out and reminds us to leave limpets safely attached to their rocks. We also include a hat (dress properly), a boot (walk only where the mud is firm), and litter (please pick up garbage if you find any). You may want to add different items for your rules.

Cleanup

High tide cleanup is as simple as wiping off loose sand and perhaps changing wet shoes. Low tide in Padilla Bay is another story. Setting clear expectations is important. Each teacher has his or her own "tolerance level" for how much mess is allowed. Be sure your students know what you expect. You should expect muddy shoes -- not necessarily muddy or wet clothing. Students should *explore* the mud, not *play* in it.

Several dishpans of water and a hose help reduce congestion at the faucet. Please wash up at the faucet at the beach, not in the rest rooms near the picnic shelter. Check for litter before you leave. Your help in keeping the picnic area and rest rooms clean will insure that we continue to have access to this fine facility and the State Park staff will appreciate your efforts.

Padilla Bay's SCAVENGER HUNT



- ☐ A clamshell the size of your thumb - another as big as your elbow.
- ☐ A bird feather
- ☐ Something mushy
- ☐ Something smooth
- ☐ A piece of wood that looks like an animal
- ☐ A crab shell with hair on it
- ☐ A crab shell with freckles
- ☐ Something pink or purple
- ☐ Something shiny
- ☐ A piece of garbage

*Please return **all** critters to their homes when you're done.*

Padilla Bay's SCAVENGER HUNT

- ☐ Clamshells: ☐ with ridges ☐ without ridges
- ☐ 4 different kinds of birds: 1 _____
  2 _____ 3 _____ 4 _____
- ☐ 3 different marine plants: ☐ ☐ ☐
- ☐ An animal track
- ☐ Something that changes _____
- ☐ Something that never changes _____
- ☐ 2 kinds of crabs ☐ ☐
- ☐ 3 unique smells ☐ ☐ ☐
- ☐ 2 different mud dwellers ☐ ☐
- ☐ Signs of human influence ☐ ☐ garbage _____

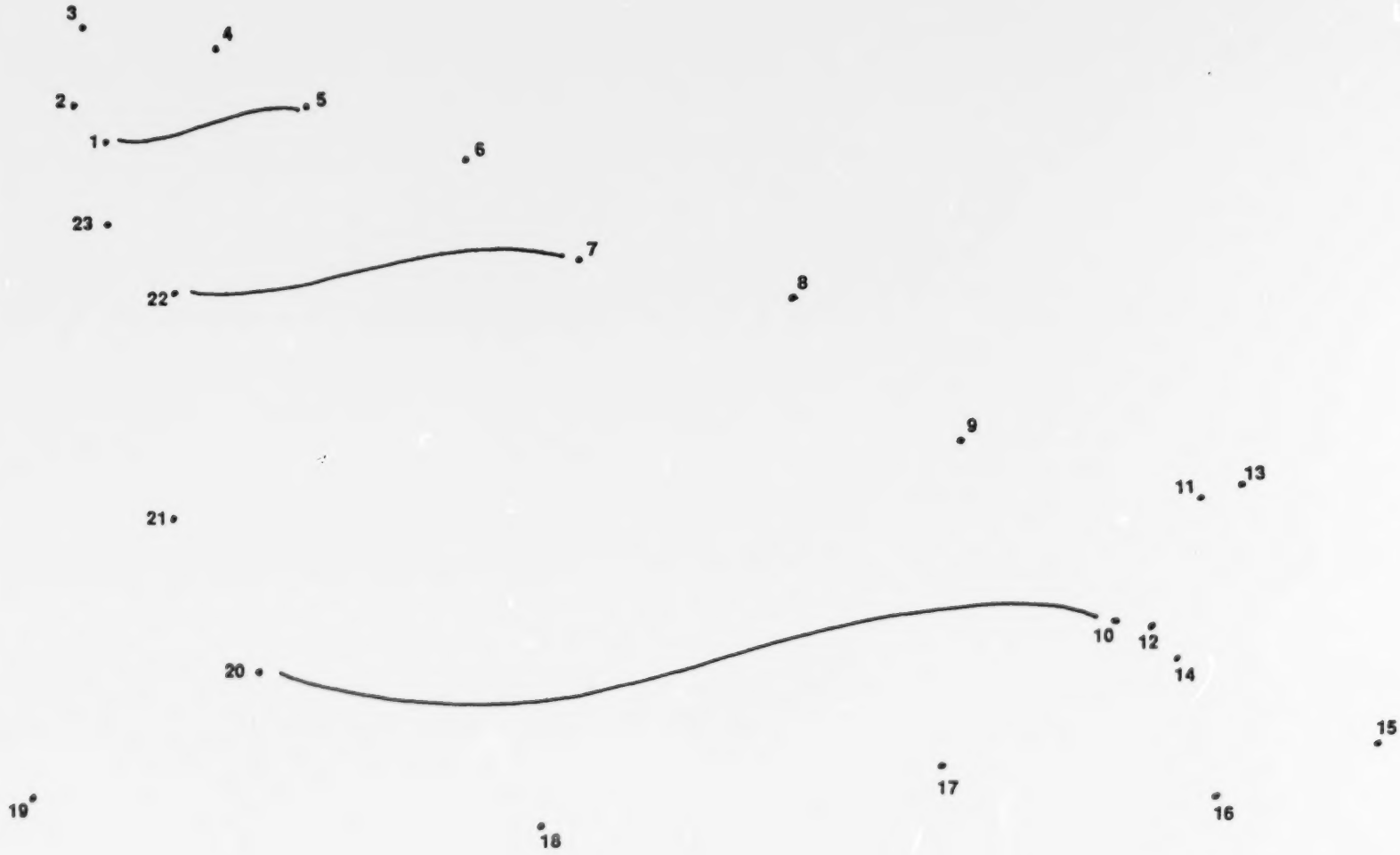
*Please return **all** critters to their homes when you're done.*

BEST COPY AVAILABLE

Post-trip

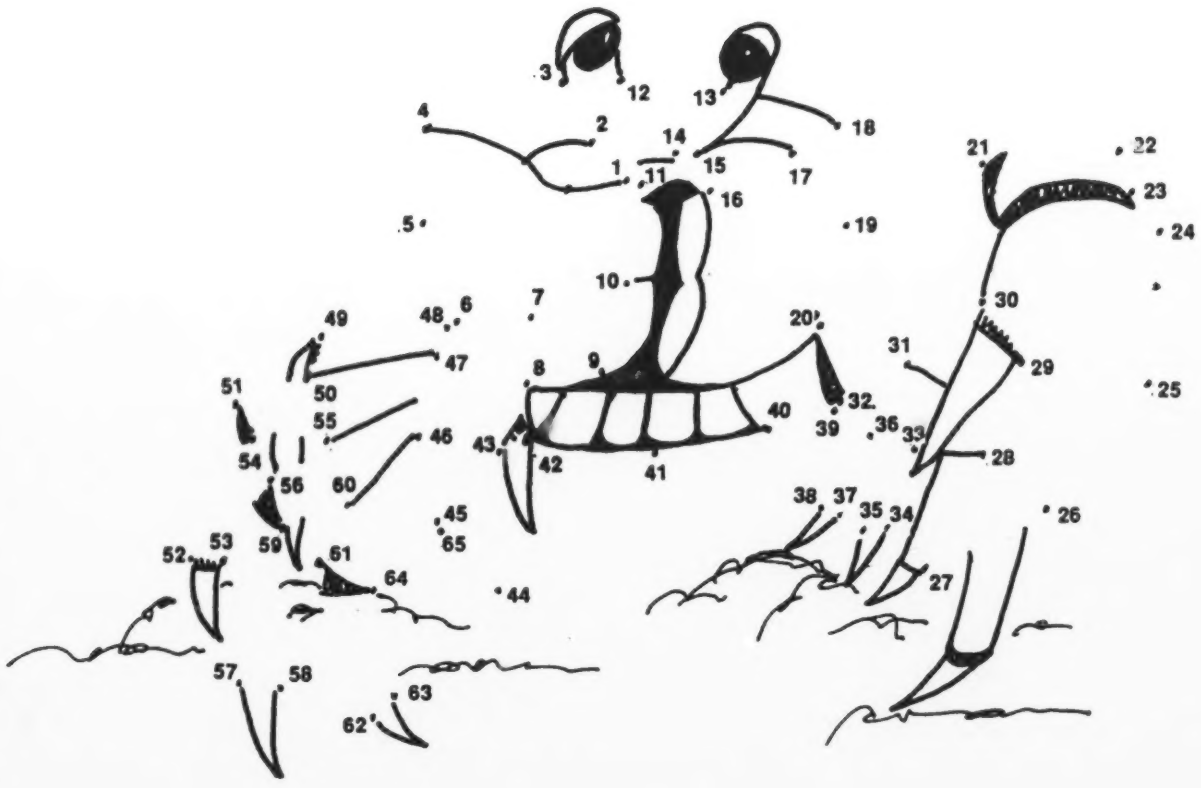
Post-trip Activities

Connect the Dots ..... p. 41
Matching Critters ..... p. 43
Whiz Quiz ..... p. 44
Maze ..... p. 45
What's Wrong? ..... p. 46
High Tide -- Low Tide ..... p. 47
Coloring Pages:
Crabs ..... p. 51
Fishes ..... p. 52
Seastars ..... p. 53
Estuary Community ..... p. 54
Key ..... p. 55
What Might Eat a Fish? ..... p. 57
Camouflaged Fish ..... p. 58
Camouflage Game ..... p. 61
Afternoon in an Estuary ..... p. 62
Estuary Tales ..... p. 64
Living by the Estuary ..... p. 66
Make a Food Chain ..... p. 69
Food Chain Game ..... p. 70
Songs ..... p. 72
More ideas . ..... p. 79



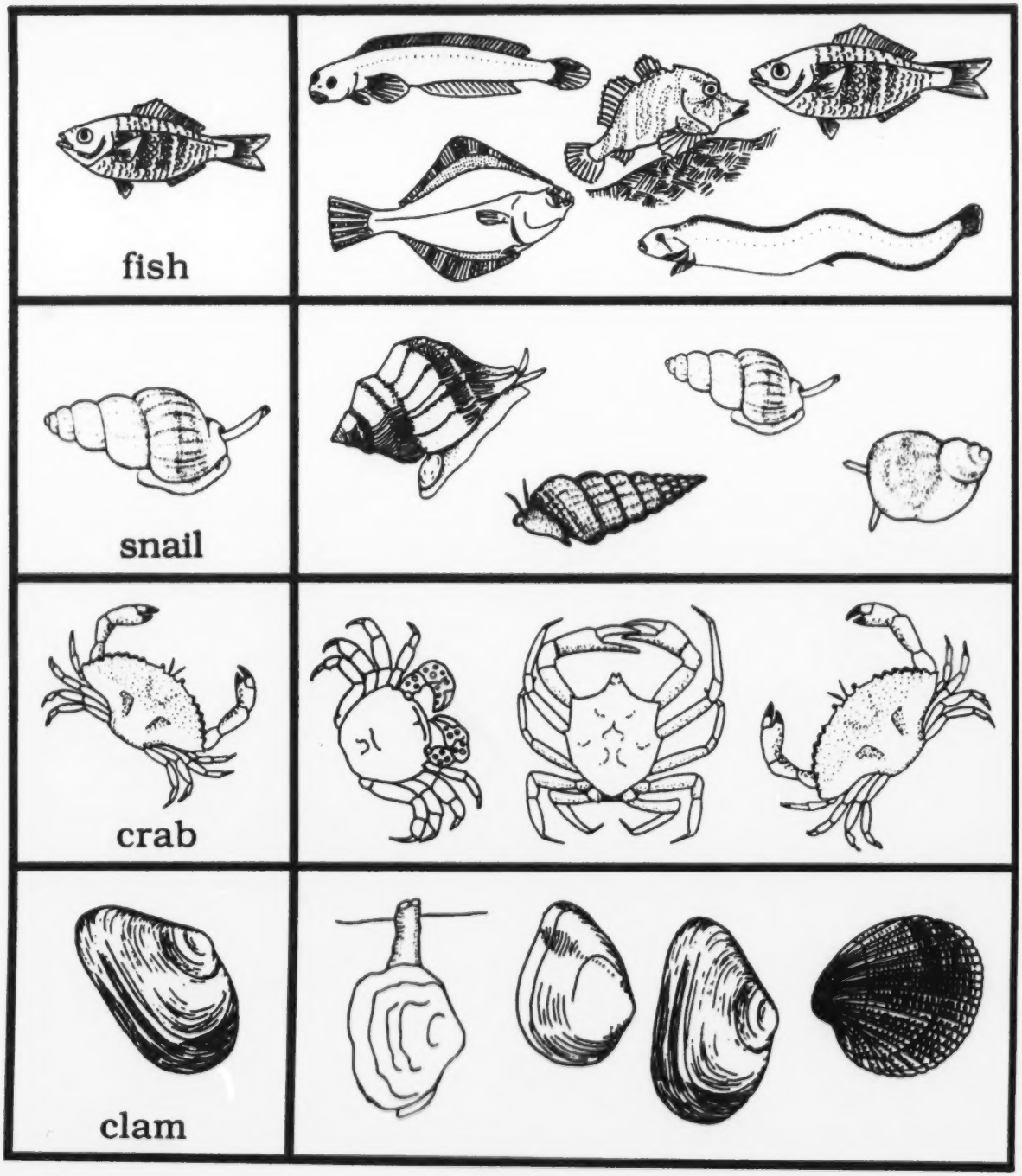
Connect the numbers to see WHO is creeping on the mudflats!

Connect the Dots (numbered 1 to 65)



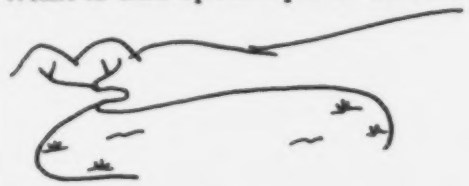
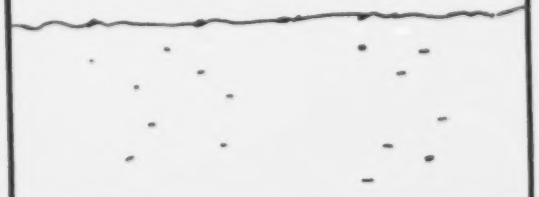
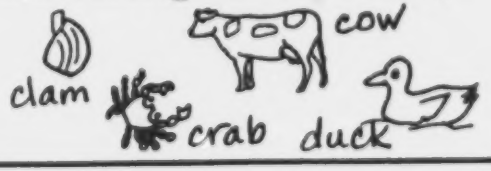
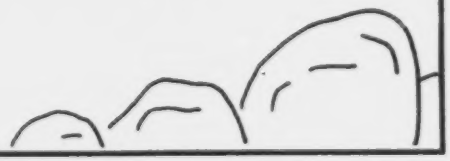
Many crabs inhabit Padilla Bay. This **Shore Crab** never gets this large. It is small enough to fit in the palm of your hand. Look for them under rocks.

Color the MATCHING Critters!

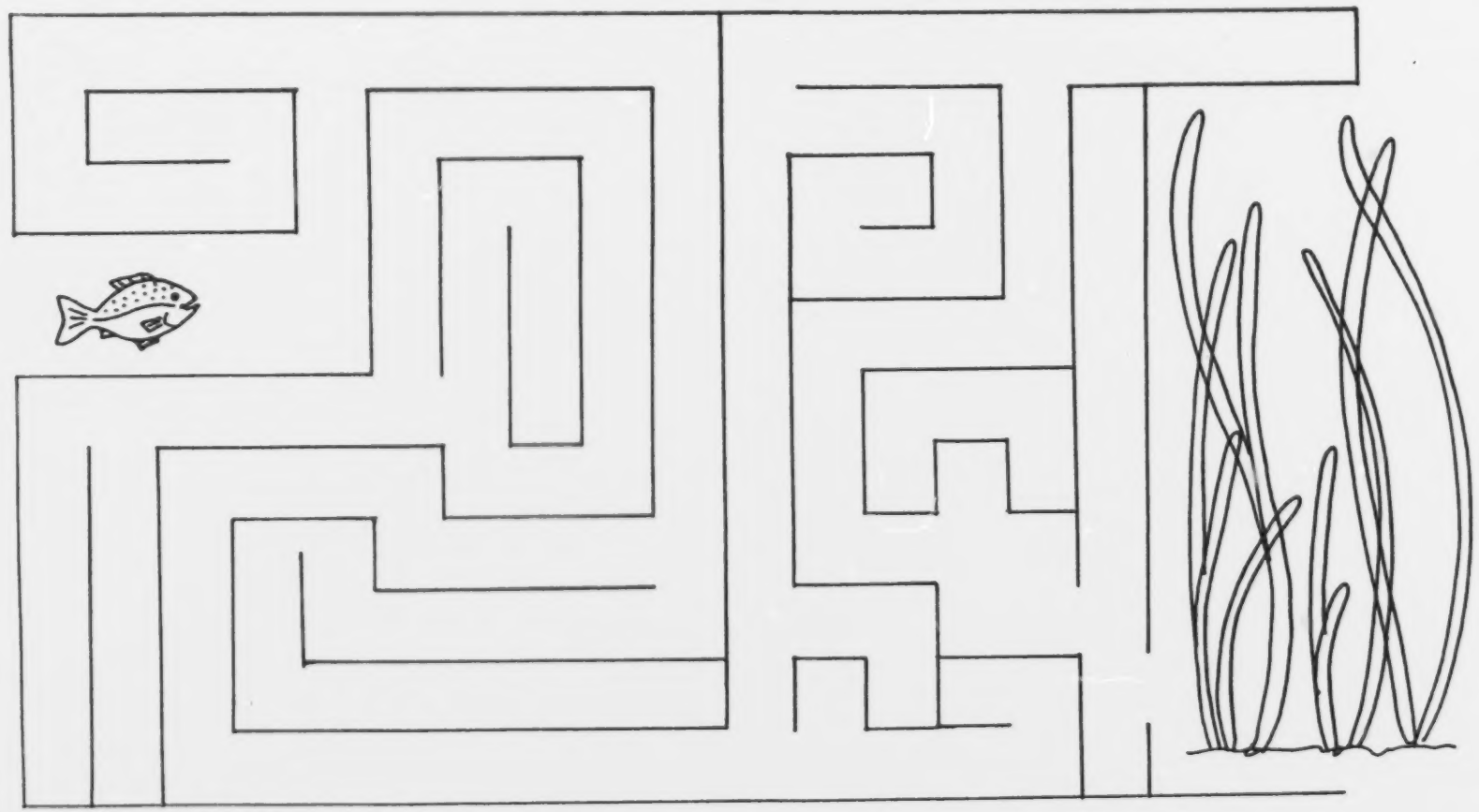


Padilla Bay's whiz quiz!

My name is _____

What is this special place called?  an _____	What 2 kinds of water mix in an estuary? 1. _____ 2. _____	Draw an animal that SWIMS in with the tide.
Draw an animal living in this mud. 	FREE SPACE 	Do you like to eat: yes no 1. clams ☐ ☐ 2. crabs ☐ ☐ 3. oysters ☐ ☐ 4. salmon ☐ ☐ 5. seaweed ☐ ☐
Tiny _____ and tiny _____ are called PLANKTON	"x" the animal that does not belong in an estuary.  	Draw an animal that lives on rocks. 

Please help this fish find shelter in the tall eelgrass.

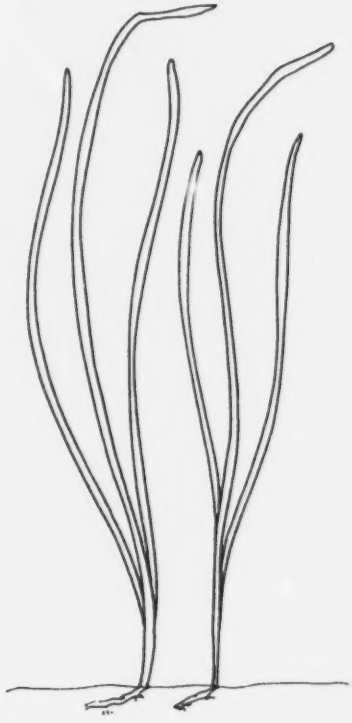


What's wrong here? People have been to this beach. Circle the mistakes they made.

Eelgrass

Which plant is at *high tide*? Which plant is at *low tide*?

at _____ tide



at _____ tide

How can you tell?

_____

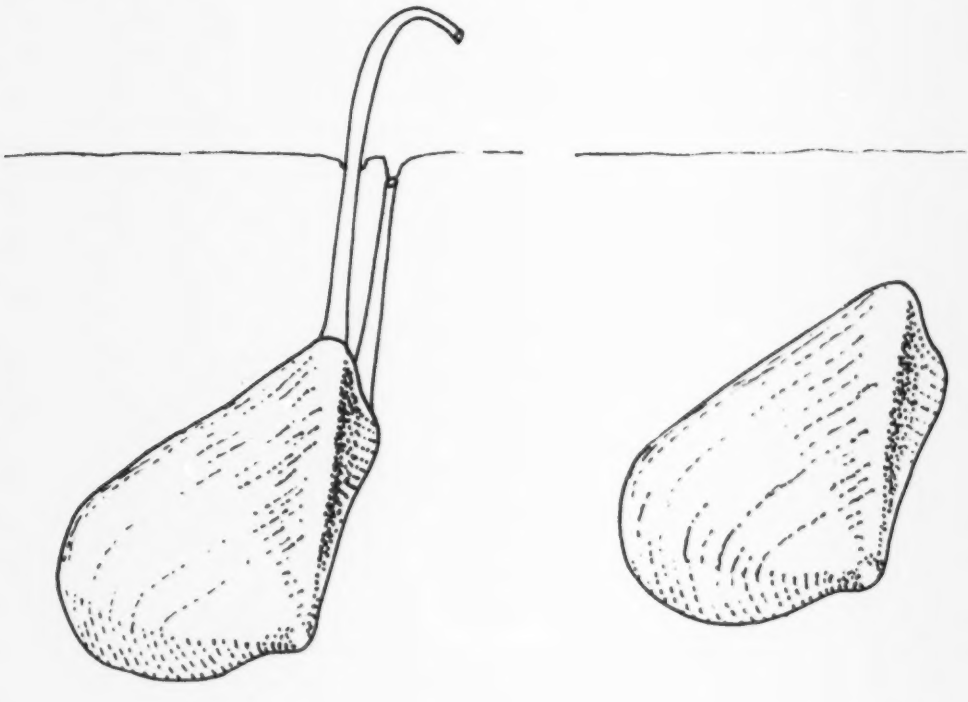
_____

_____

_____

Clams

Which clam is at *high tide?* Which clam is at *low tide?*



at _____ tide

at _____ tide

How can you tell?

_____

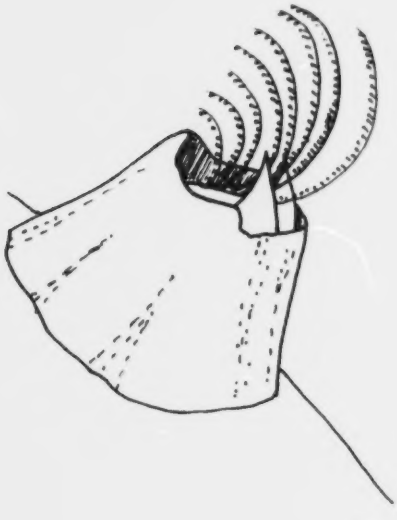
_____

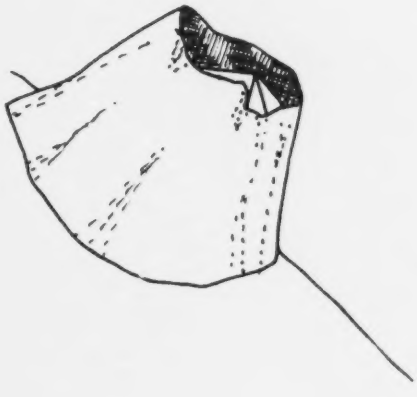
_____

_____

Barnacles

Which barnacle is at *high tide*? Which barnacle is at *low tide*?





at _____ tide

at _____ tide

How can you tell?

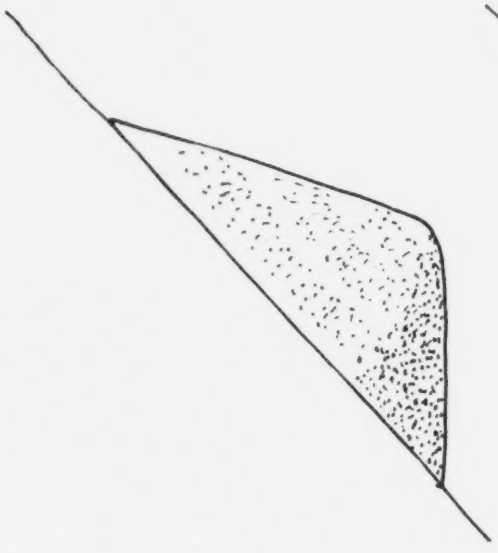
_____

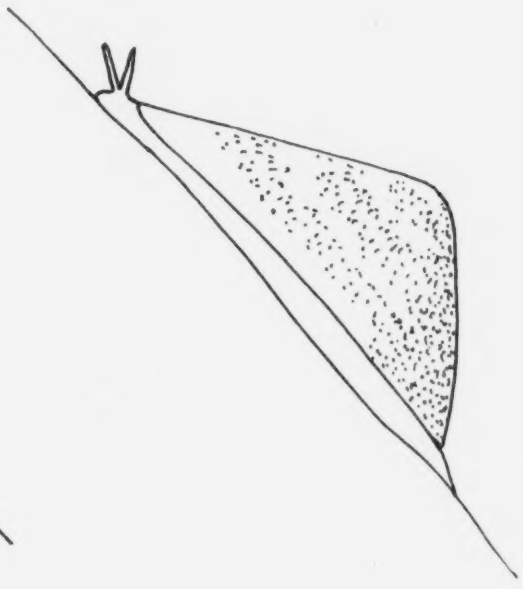
_____

_____

Limpets

Which limpet is at *high tide*? Which limpet is at *low tide*?





at _____ tide

at _____ tide

How can you tell?

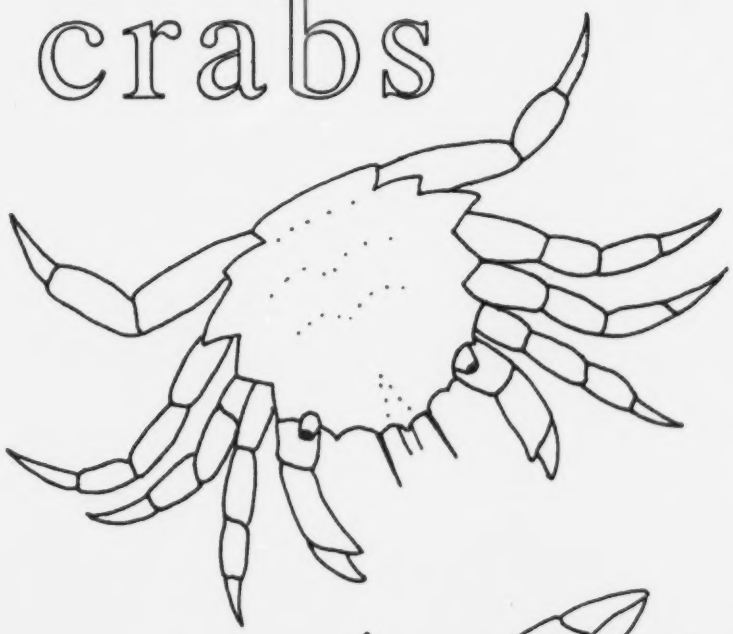
_____

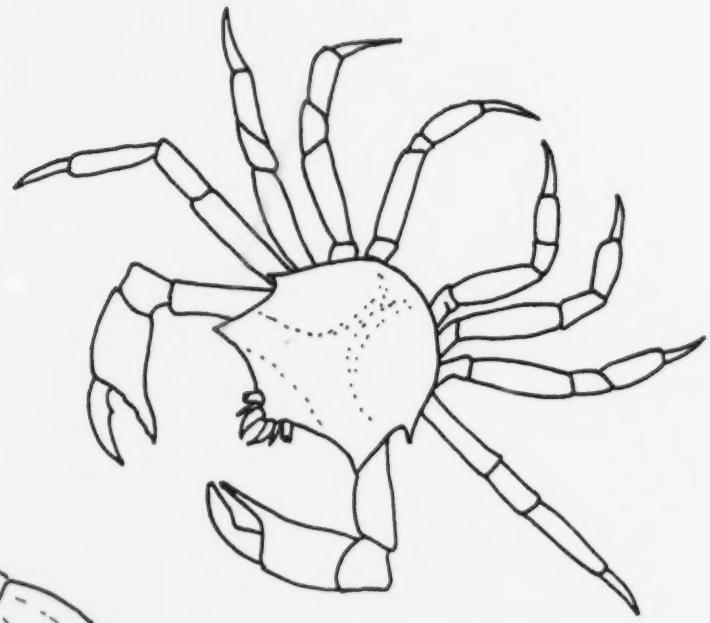
_____

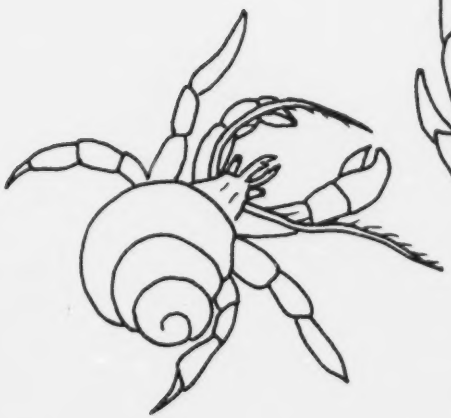
_____

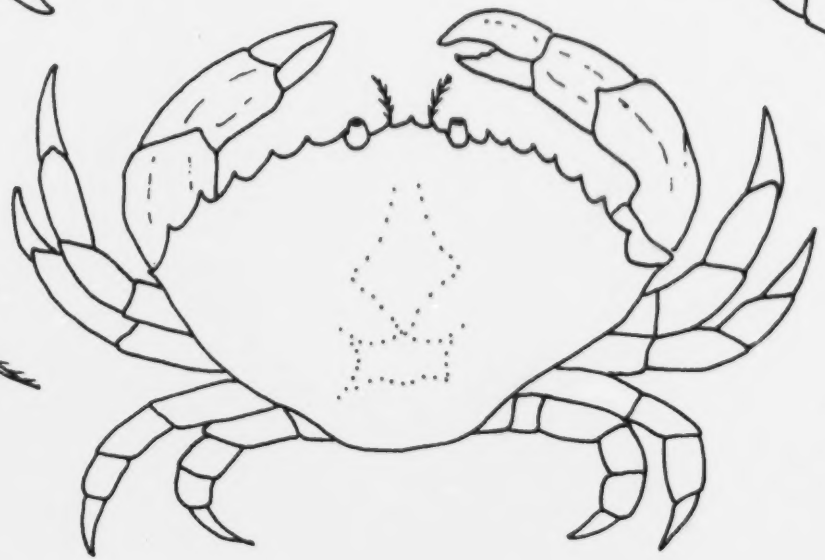
_____

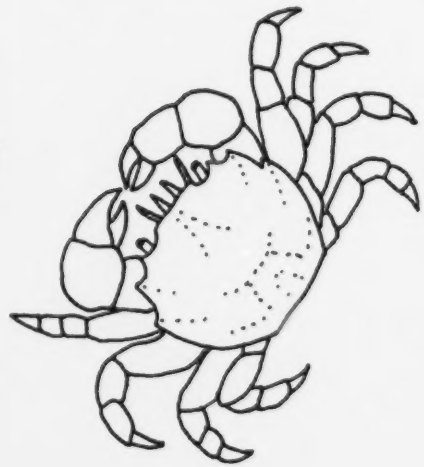
crabs











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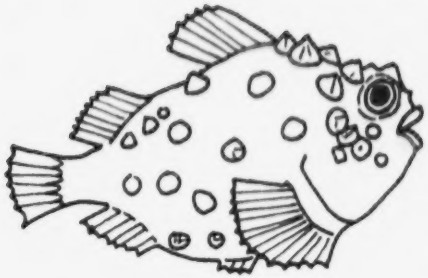
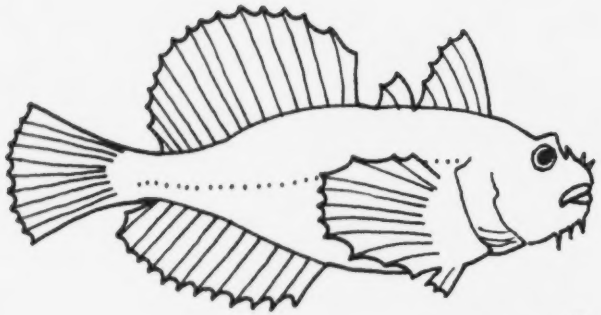
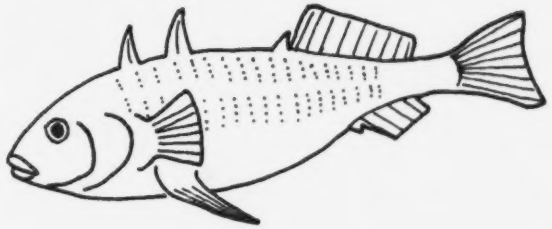
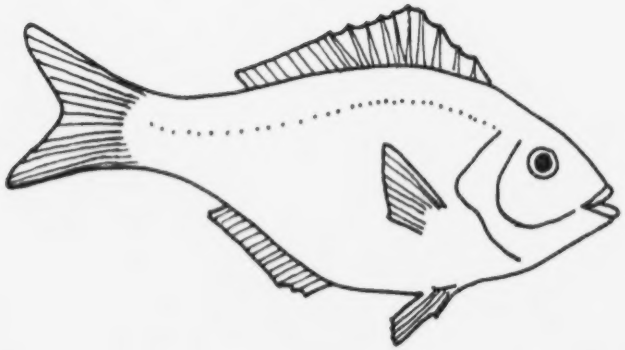
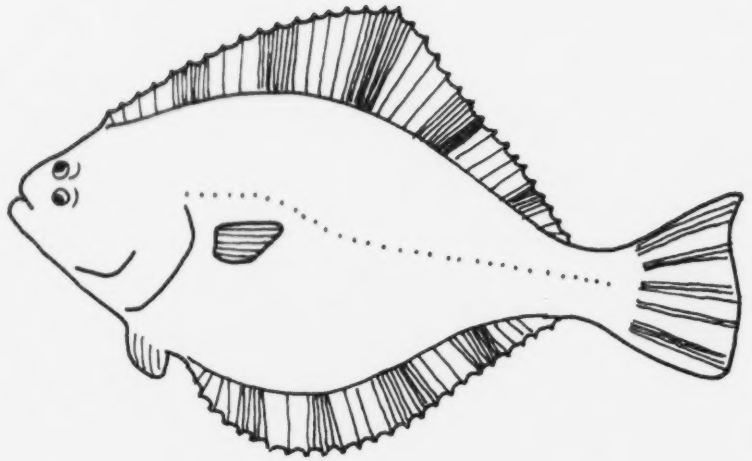
63











fish

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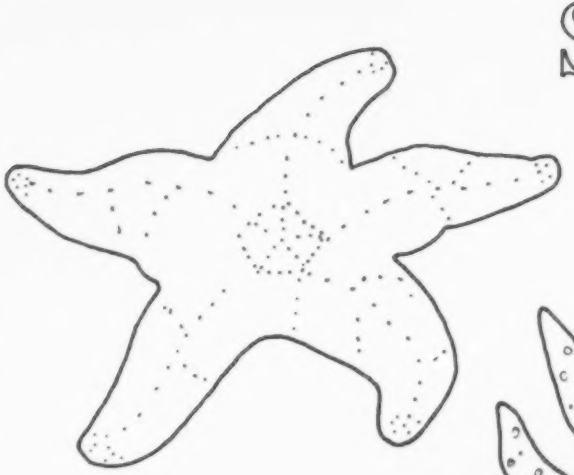
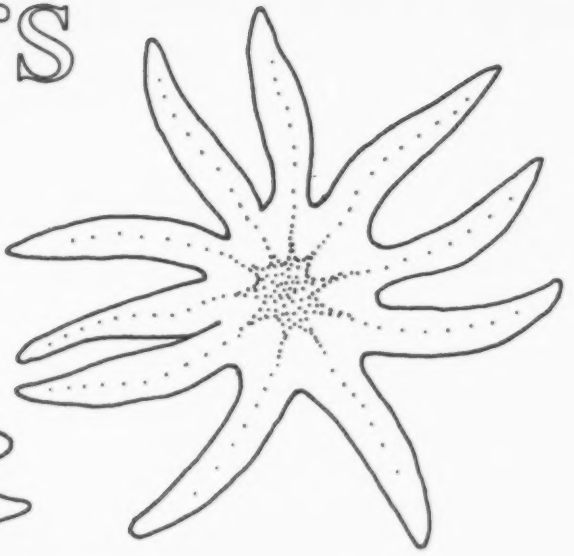
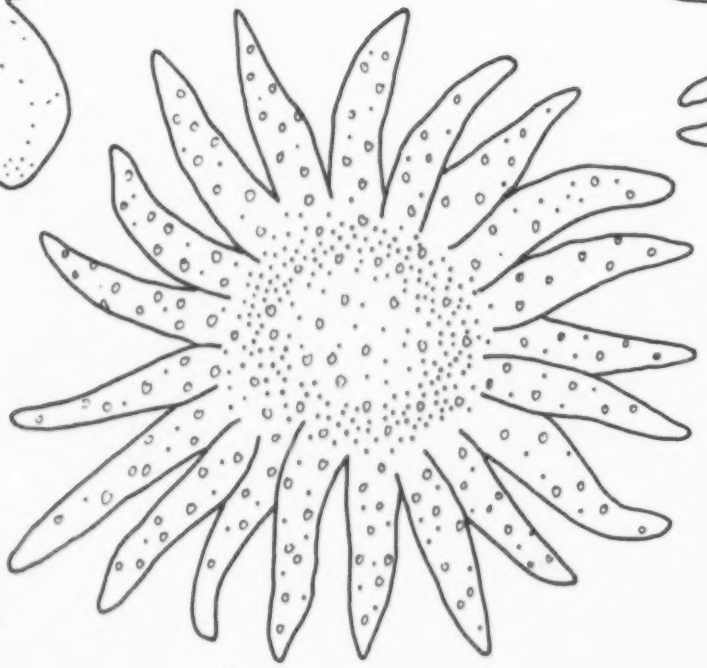
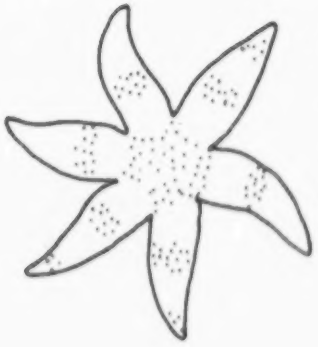
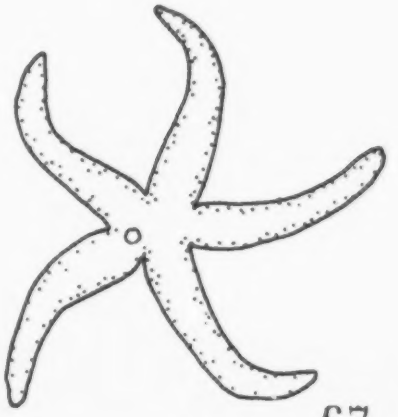
seastars











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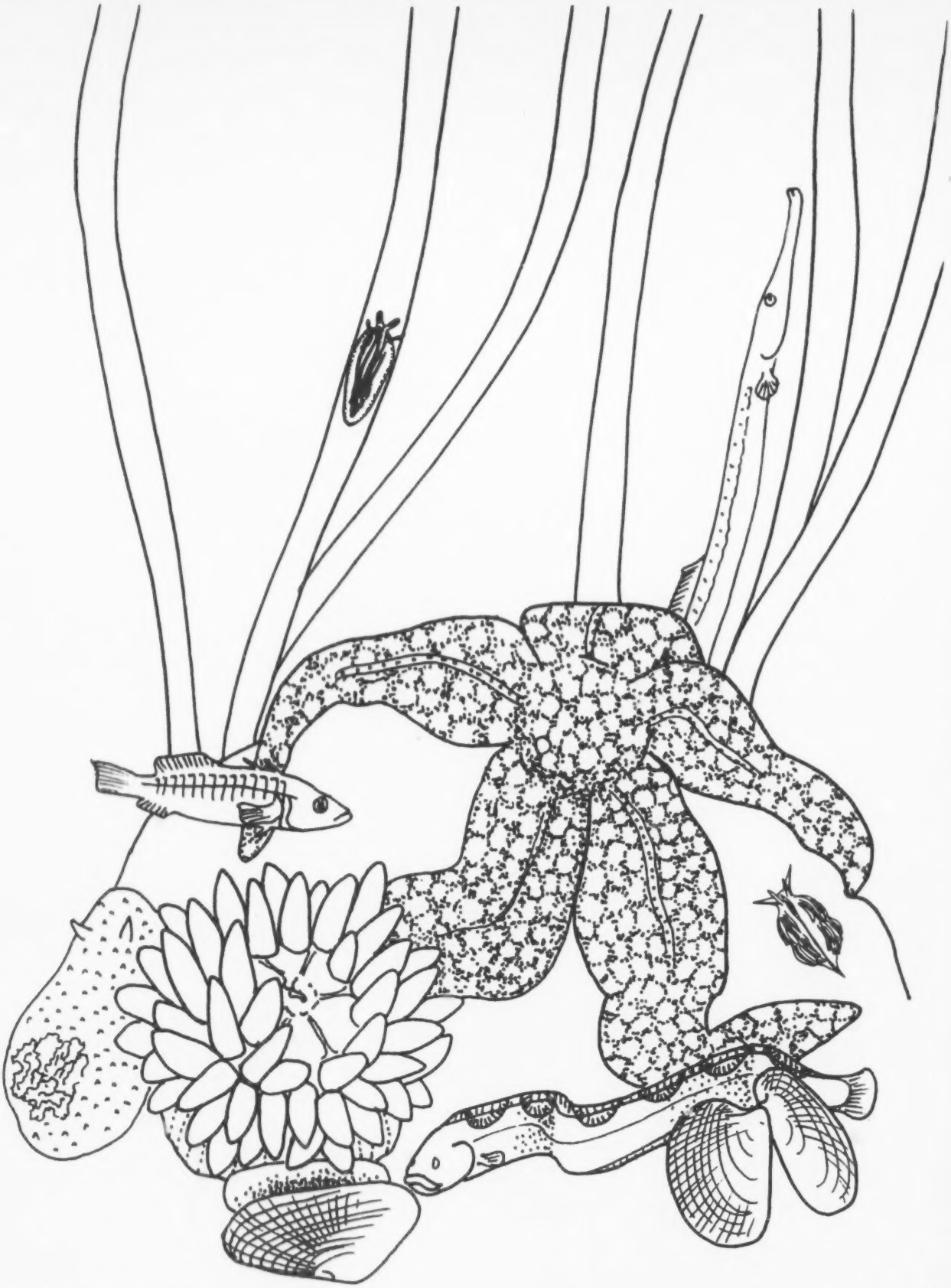
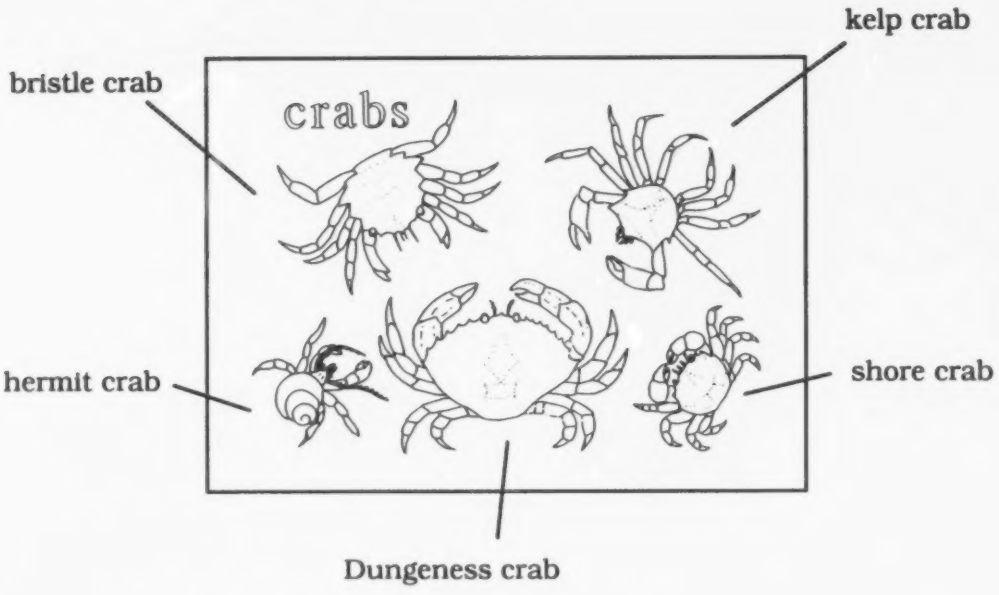
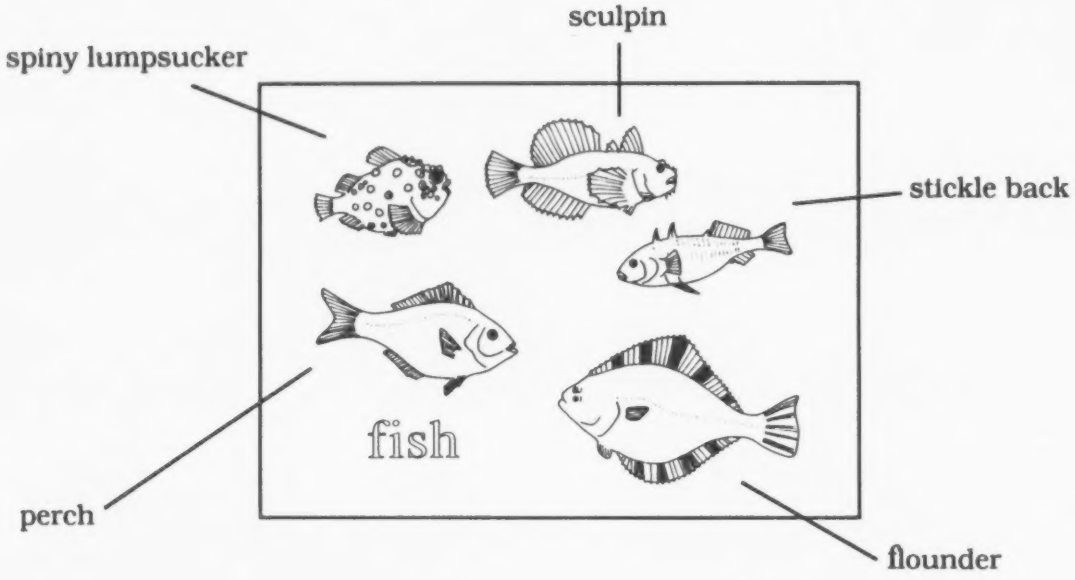
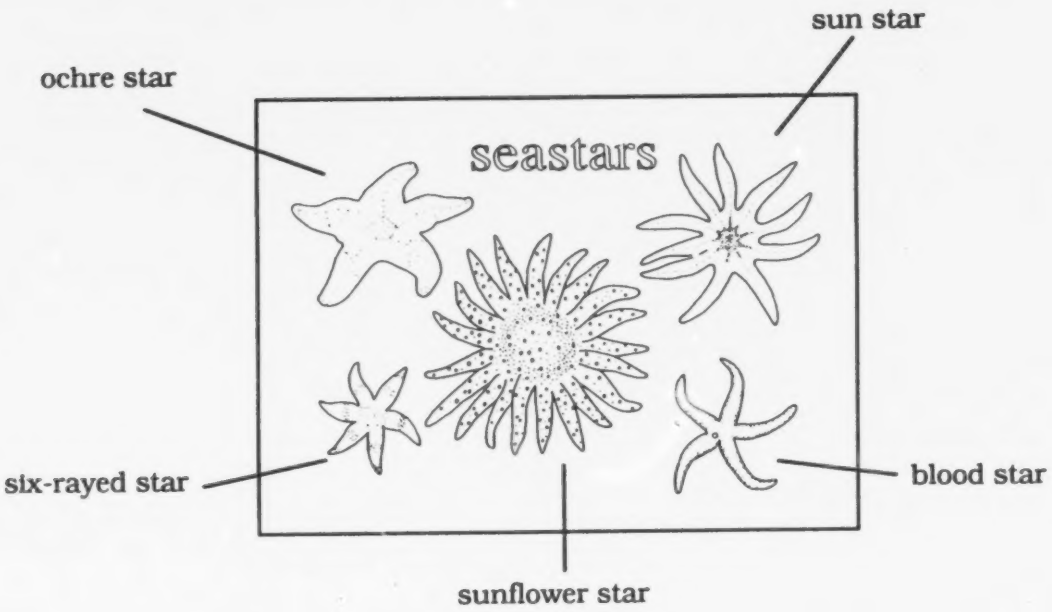


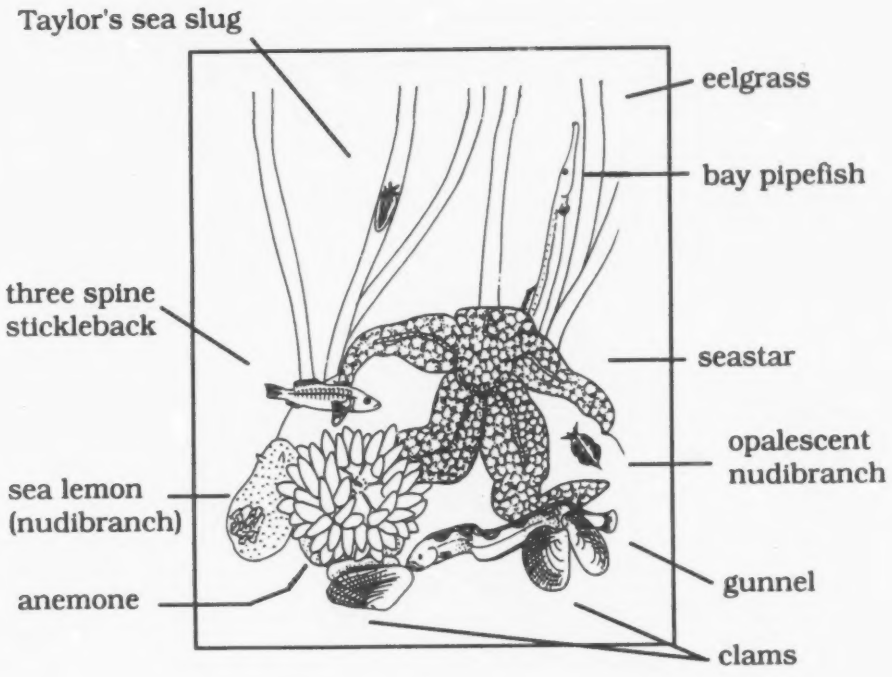
Coloring Pages -- Key

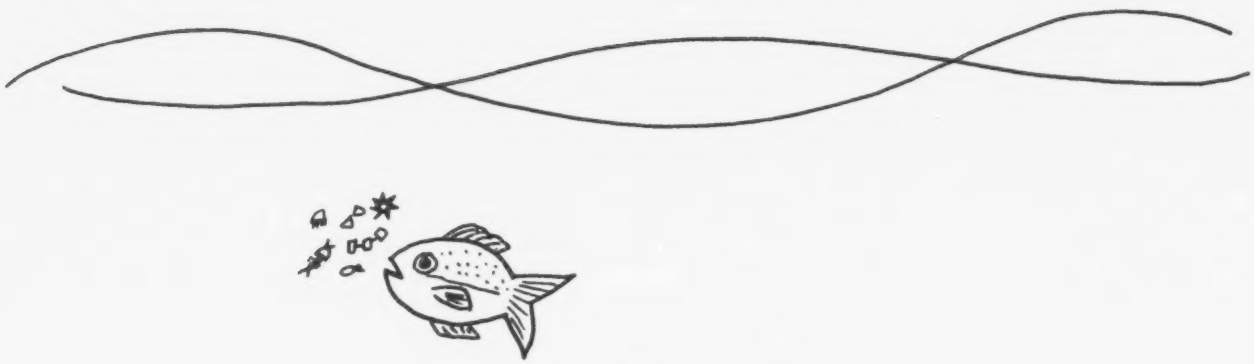




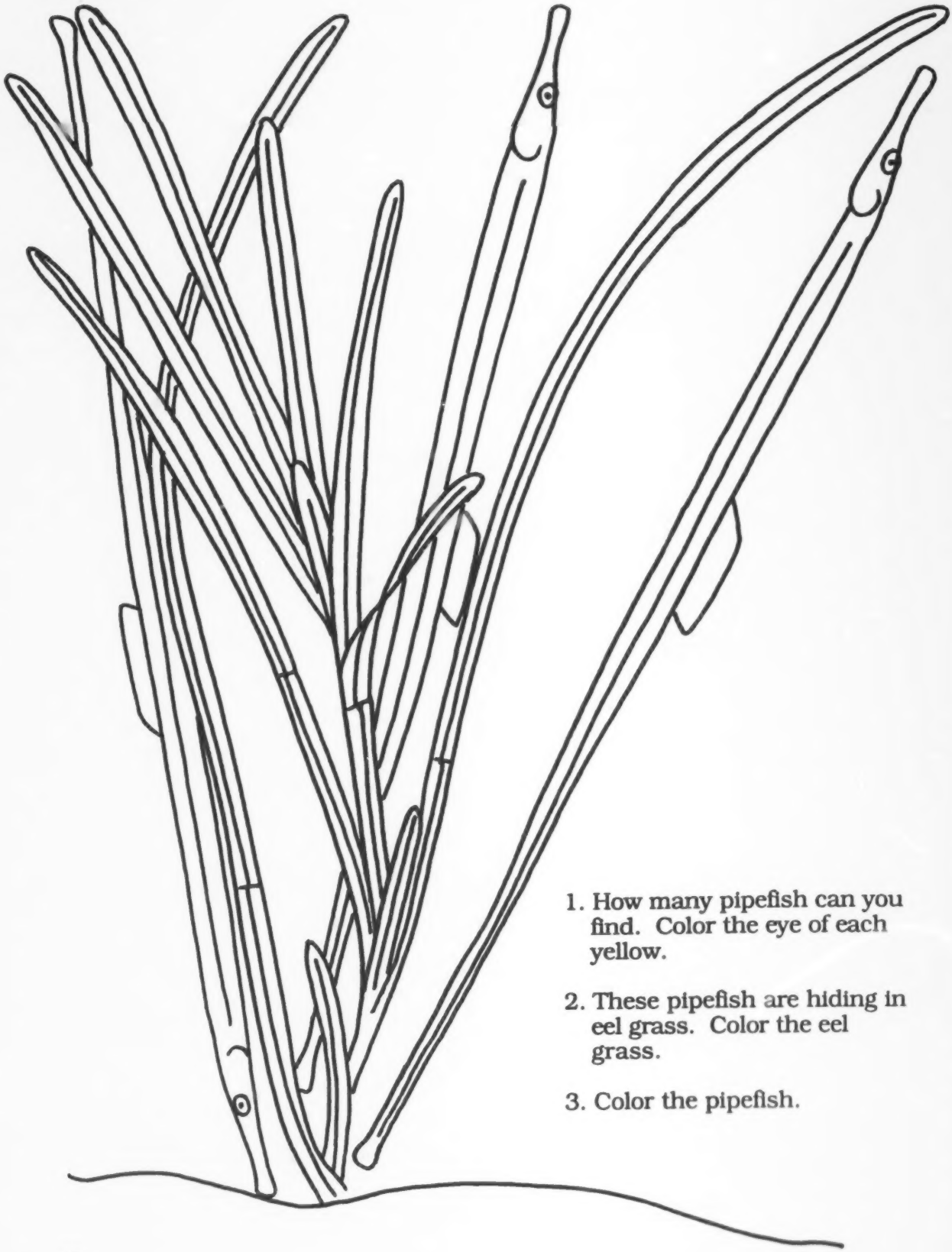
Post trip


sun star
ochre star
seastars
six-rayed star
blood star
sunflower star


Taylor's sea slug
eelgrass
bay pipefish
three spine stickleback
seastar
opalescent nudibranch
sea lemon (nudibranch)
gunnel
anemone
clams



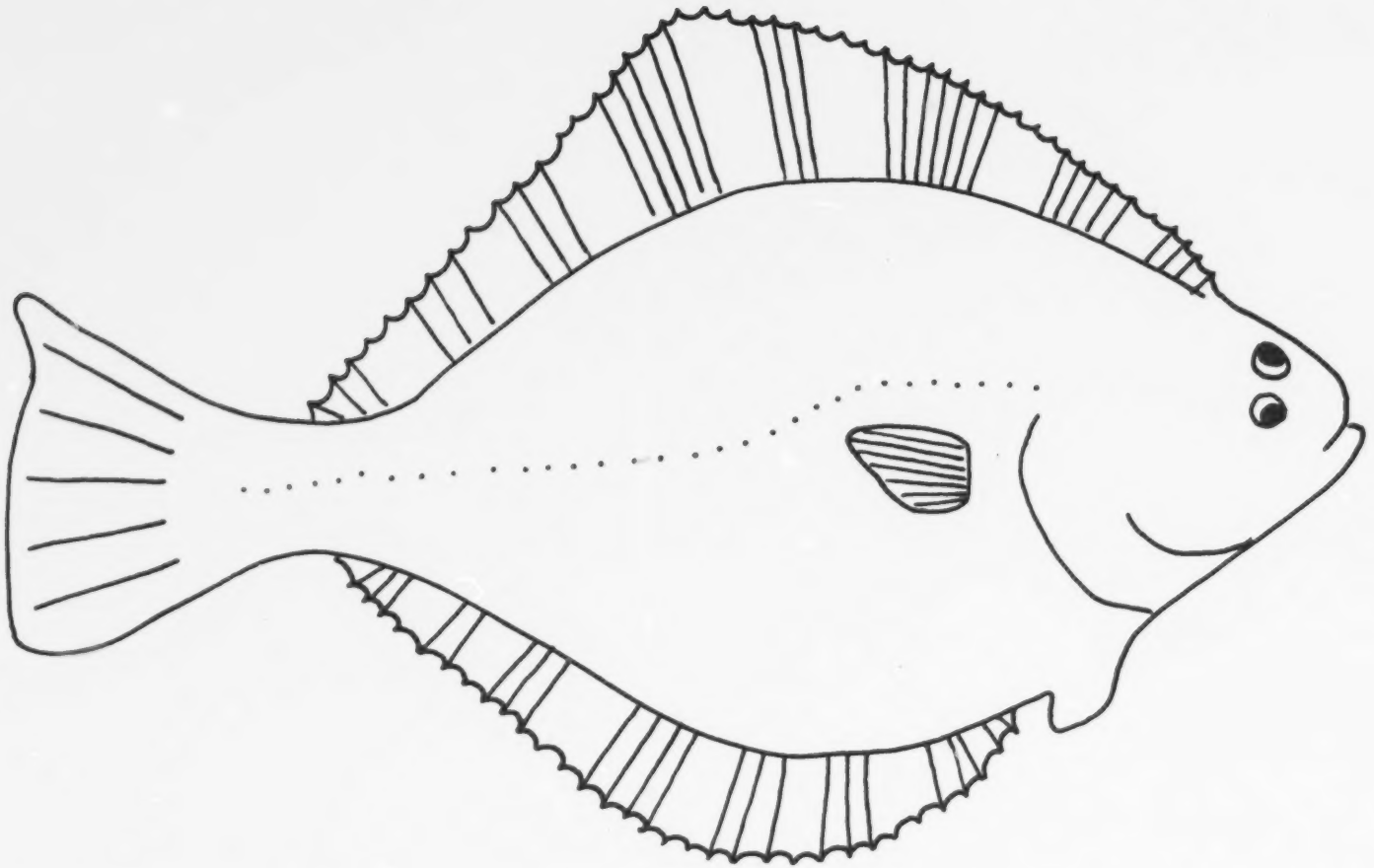
Many animals feed on other animals. What might eat this fish?



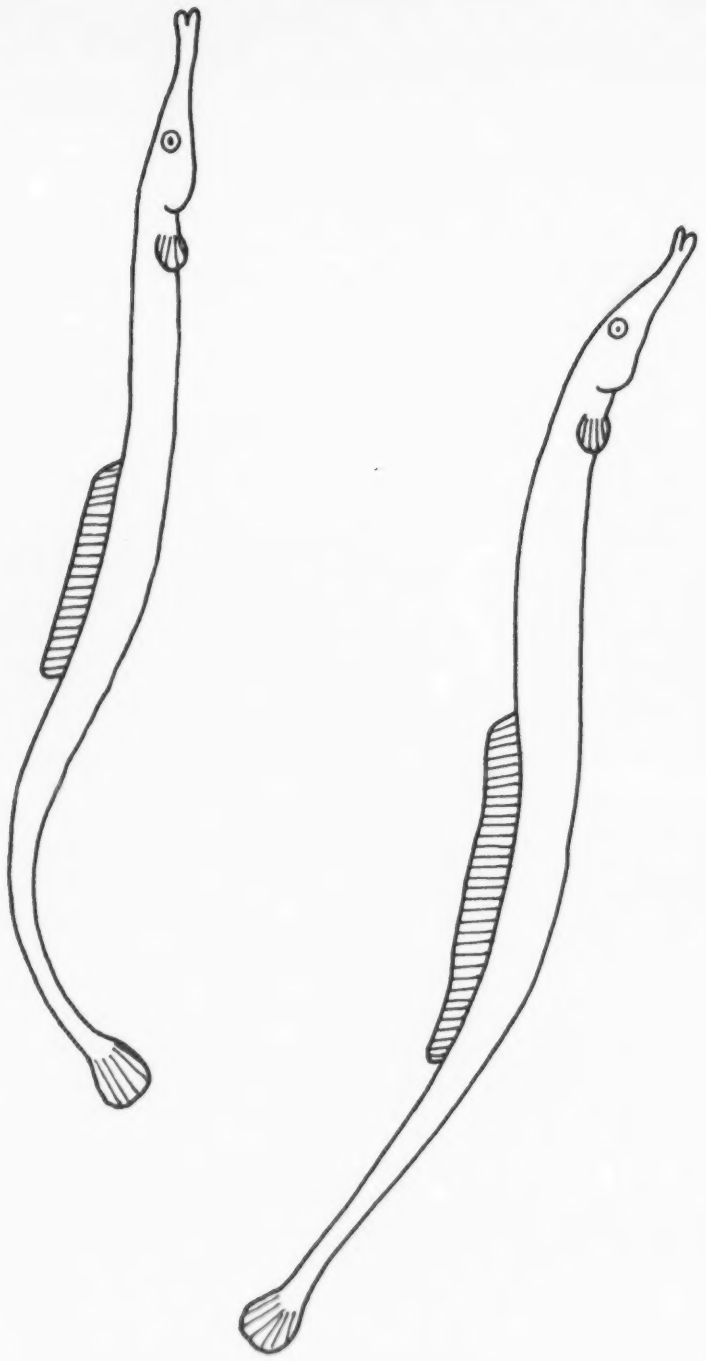
1. How many pipefish can you find. Color the eye of each yellow.

2. These pipefish are hiding in eel grass. Color the eel grass.

3. Color the pipefish.



Flounder can change color quickly to match their surroundings.
Give your flounder a background. Then color the flounder to match.



Color the pipefish. Glue on green paper eelgrass to help them hide.

Camouflage Game

This simple game demonstrates how camouflage works.

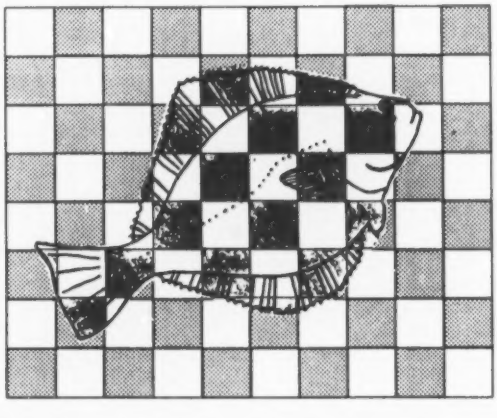
Spread colored toopthpicks or 1/2" squares of construction paper (5-10 pieces per student) around the playing area. An outdoor grassy or wooded area is best, but not necessary. Make the area large enough that your class can fit comfortably inside, but not so large that the toothpicks will get hopelessly lost. Try to have nearly equal numbers of each color - the more colors, the better.

Give students a very short time (30 seconds) to look for the toothpicks. Put the whole group's collection together and see which colors they found. In a grassy area, there will most likely be very few green toothpicks in the collection. In a forest, browns and yellows may be missing.

Send the children back into the play area to find the rest of the toothpicks. Which colors were the last to be found? Why?

Many animals rely on camouflage for protection from predators. Ask the class to name some.

You may want to have your students color the pipefish and/or flounder coloring pages as follow-up.



Flounder can change color quickly to match their surroundings.

Post-trip

Afternoon in the Estuary

Read aloud to your class, allowing time for drawing at each pause (. . .).

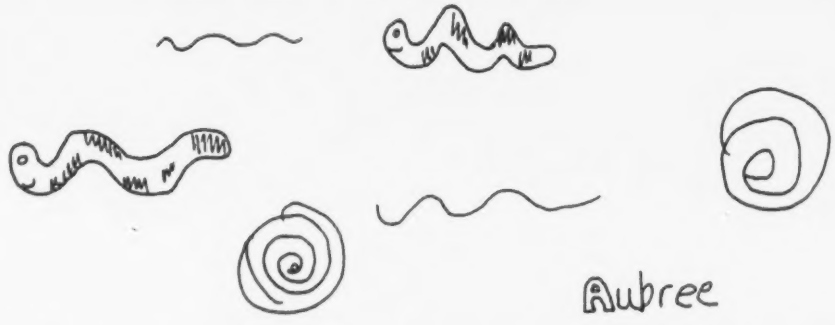
Imagine that you are in a motor boat going down a river. After two hours of motoring downstream, you come to the mouth of the river, where it meets the ocean. This area, where fresh water from the river meets the salt water of the ocean, is called an ESTUARY. Near the top of your paper, draw yourself and the boat on the water in the estuary . . . Because the tides from the ocean can pull your boat further out to sea, you will need your motor on. Indicate that your motor is on . . .

Although the estuary will be deep where the main channel of the river is, it will be shallow along the shore and in much of the estuary itself. Draw some areas of shallow bottom under your boat . . . Now draw yourself lowering a rope to measure the depth of the estuary . . .

Because the water is so shallow in an estuary, a lot of sunlight can get through the water to the plants that grow on the bottom. Draw lots of algae and eelgrass on the estuary's floor . . . The rivers that flow into the estuary carry soil from the land, bringing lots of nutrients for the plants to use for making food. This, the sunlight, plus the combination of fresh and salt waters, allows many plants to grow. Many more plants tend to grow in an estuary than in a similar area in the open ocean.

But many of these plants are so tiny that one needs a microscope in order to see them! These, in turn, are eaten by tiny animals. These tiny plants and animals that float in the water are called PLANKTON. Draw lots of these microscopic plants and animals in the water under your boat . . .

Many animals eat this floating food by filtering it from the water. Draw a barnacle, one of the filter-feeders, on a rock in the bottom of your estuary . . . When animals and plants die, they drift to the bottom and rot, becoming DETRITUS. A worm is one kind of animal that eats this decaying food. Then it becomes food for other animals. Draw some worms on the bottom . . .



Small fishes not only find food in an estuary, they can also hide from predators in the algae and eelgrass. Draw lots of little fishes feeding and hiding in the eelgrass . . . Because there are so many little fishes, larger fishes come to the estuary and try to catch them. Draw a large salmon looking for a tasty meal . . .

Now draw an animal that might eat a salmon -- for example, a harbor seal or bald eagle . . . Now that you know that there are large salmon in your estuary, you are getting hungry. On the back of your paper, draw yourself eating a tasty meal from an estuary . . .

Adapted from "Clean Water, Streams and Fish" WA State Office of Environmental Education

Post-trip

Estuary Stories

Read or tell a story that explains a natural phenomenon, and then let the students create their own tales. Rudyard Kipling's *Just So Stories* ("How the Camel got its Hump," etc.) and *Why Mosquitoes Buzz in People's Ears*, by Verna Aardema, are familiar examples of these stories that tell "how it came to be." Collections of stories from other cultures (Native American, African, Asian, etc.,) are good sources for a such a tale. Your librarian should be able to help you locate the right story for your class.

An excellent "estuary tale" is the Tahtlan story from Northern British Columbia which explains the tidal cycle. "Why the Tides Ebb and Flow" is the story of how Raven provided food for the people by making intertidal plants and animals available to them. Raven discovers a great big man sitting on a hole in the earth. If the man gets up, the water pours into the hole, the tide goes down, and people have food. By placing sharp rocks under the man, Raven convinces him to stand up twice every day, long enough to let the water recede so that the people can gather seafood on the shores. This story can be found in the book, *How the People Sang the Mountains Up*, by Maria Leach, published in 1967 by Penguin Books. It is also available in the collection, "Wetland Tales," published by WA State Department of Ecology. Call the Publications Office at (206) 407-7472 for a free copy (publication no. 92-17).

Introduce the story by talking about tales that explain why the world is the way it is. The discussion might go something like this: "Did you ever notice how well things work in the world? For instance, it is good that the sun goes down at night so you can get sleepy. Then when the sun comes up, you can wake up, ready for all the things you like to do in the daytime. Now what would happen if the sun did not go down? Or what if it was always night? Did you ever wonder how it was that the world got fixed up to work so well? The first people to live in this part of the world, long ago, believed that it was Raven that fixed the world and helped people learn how to live. In other parts of the world, people had different stories that explained how the world works and why animals look and act the way they do. . ."

After reading the story, talk about estuaries and how they work so well. Name animals that are specially adapted to live in their estuary habitat. Talk about people living near and using estuaries. Imagine what it would be like if estuaries or estuary animals were different, perhaps not so well "fixed up."

Post-trip

Have your students create their own stories about something in the estuary. (Why crabs have claws, how the heron got long legs, why the river always runs down to the sea, etc.) Younger children can tell their stories to each other. Older ones can write and illustrate them. The class could work together on a longer story. Send copies of your stories to Padilla Bay. We'd love to share them!

Living by the Estuary

Directions: Read the following stories and answer these questions.

1. How are Fern's and Susan's lives the same?

2. How are Fern's and Susan's lives different?

3. If you could live with Fern's or Susan's family, which one would you choose? Why?

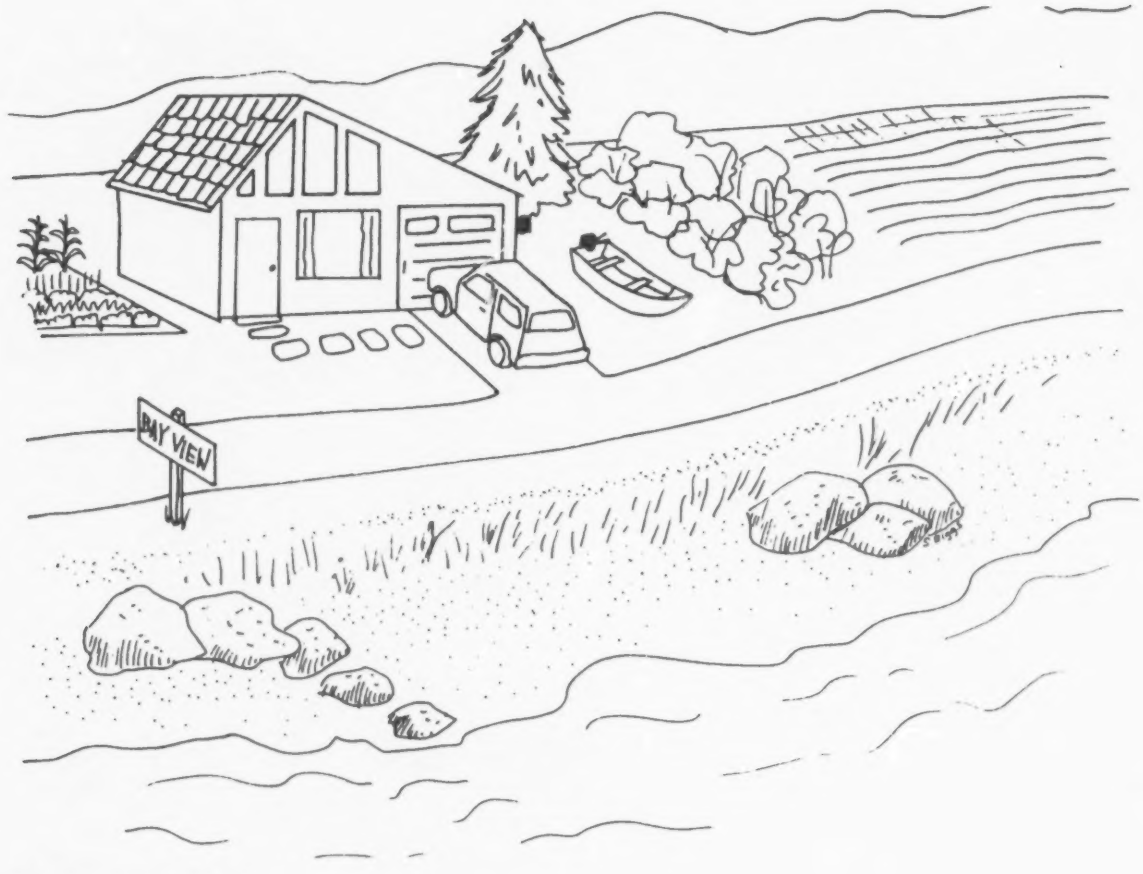
4. Think of a bay, lake, or river where you live. What kinds of things do you like to do when you visit there?

Adapted from "Hanging on to the Wetlands" by David Newton and Irwin Slesnick.

A Samish Home -- 1850's

Fern's Story

My home is built on the edge of Padilla Bay. It is made of cedar boards. My family travels only by water in a canoe that was carved out of a cedar tree. We get much of our food from the estuary. I help my mother gather clams, crabs, oysters, and seaweeds when the tide is low. My father and brothers fish and hunt birds that come to the estuary. In the summer, I like swimming in the bay. It is fun to see all the animals that live on the beach. All my friends and relatives live here, too. In the winter, it can get very cold and windy by the water, and everyone has to work hard to stay warm and have enough food to eat. Still, I am very happy to be living by Padilla Bay.



A Modern Home -- 1990's

Susan's Story

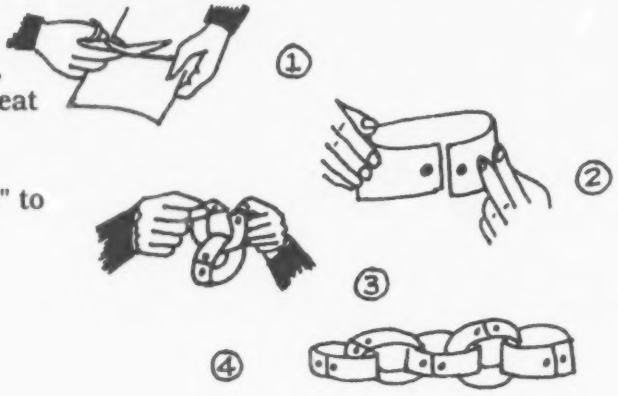
My home is a new house with cedar siding built on the shore of Padilla Bay. Before it was built, the land here was a mudflat. The mudflat was diked and drained to make good farmland. Almost all of our food comes from a store in town, 12 miles away. We have a car and a motor boat. My parents both work in town. In the winter it is cold, wet, and windy here by the water. But in the summer I like to swim and play at the beach. Sometimes we dig for clams or go crabbing or fishing. We live far away from the mall and most of my school friends. Still, I am very happy that I live by Padilla Bay.

Make a Food Chain

Here is one way to show a FOOD CHAIN. Below are five strips. Each strip makes a link in a food chain. Tape the links together in the order you think is correct.

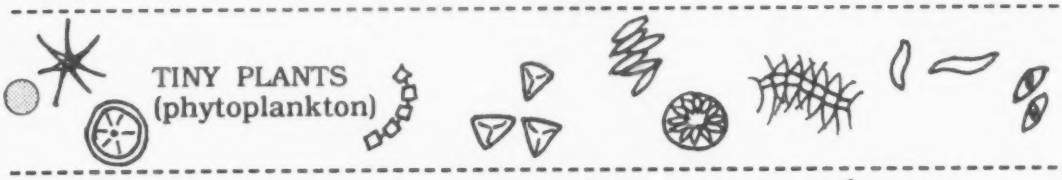
Hint: Start with the tiny plants, then add something that might eat tiny plants.

Extra: Add a link that says "Me" to a link that you like to eat.



BABY FLOUNDER

TINY PLANTS
(phytoplankton)



SHRIMP

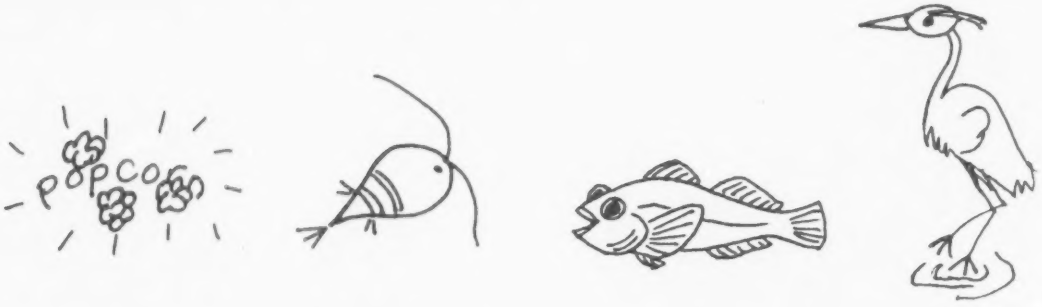
GREAT BLUE HERON

TINY ANIMALS
(zooplankton)

Post-trip

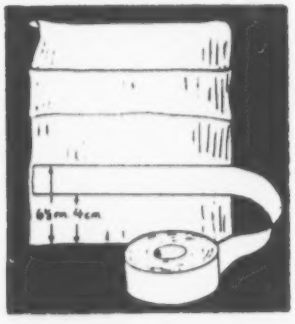
Food Chain Game

Background: The transfer of food from its source - plants - to one or more organisms is called a FOOD CHAIN. This transfer occurs when one organism eats another. The food chain in this game consists of four links:



phytoplankton (tiny plants) | zooplankton (tiny animals) | sculpins | great blue herons

Popcorn represents the phytoplankton. Students play the roles of zoo plankton (plant eaters), sculpins (which eat zooplankton), and great blue herons (which eat the sculpins). Each student tries to get enough to eat without being eaten during the timed course of the game.



You will need:

- 1 large paper bag of unsalted popcorn
- 1 timer
- roll of 1" masking tape
- 1 plastic sandwich bag (stomach) for each student. Place a strip of masking tape parallel to the bottom of the bag, 1 1/2" from the bottom.
- color coded "sashes" (fabric or paper) For every 3 students, make 2 zooplankton sashes, 1 sculpin sash, and 1 great blue heron sash.

How to play:

1. Briefly review food chains. Outline the boundaries of the game area, an area of approximately 15 yards square. This game is best played outdoors or on an uncarpeted area.

2. Spread the phytoplankton (popcorn) over the area. Tell your class you are spreading out the phytoplankton for the zooplankton to eat.

3. Divide the students into 3 groups and distribute the sashes and plastic bag stomachs. Give one group zooplankton sashes and tell them they need to fill their plastic bags with popcorn to the bottom of the tape to survive. Give a second group sculpin sashes and instruct them to fill their bags to the top of the tape. The third group gets great blue heron sashes and must fill their stomach to the top to survive. Great blue herons tag sculpins. Sculpins eat zooplankton, and zooplankton eat the phytoplankton (popcorn). If a great blue heron tags a sculpin the sculpin must surrender the contents of its stomach and leave the game. If a sculpin tags a zooplankter, the zooplankter must surrender the contents of its stomach to the sculpin and leave the game.

4. Set the timer for five minutes and "GO!" The first game usually lasts only a few seconds with one of two things happening. The zooplankton are gobbled up before they have a chance to forage, or the sculpin are gobbled up and the zooplankton continue to eat popcorn.

5) Record the numaber of each kind of animal that survived. Have students suggest rules that might allow all four links of the chain to still have survivors after five minutes of play. Suggestions may include:

   a. Change the ratio of zooplankton to sculpins and herons.

   b. Let each zooplankter come back as another zooplankter once after being captured and transferring its stomach contents.

   c. Provide a "safety zone" for zooplankton and /or sculpins.

   d. Timed releases. Let zooplankton go first to forage. One minute later release the sculpins, and then one minute later, the herons.

6. Replay the game and modify your rules several times until a balance is achieved.

Conclusion: Analyze the results of each game. Compare this game to a real food chain. How are your rules similar to or different from how it really works?

How about making extra popcorn to eat?!

Post-trip

The Eating Song

1. This is the way the seastar eats,
   The seastar eats, the seastar eats.
   This is the way the seastar eats,
   Slipping its stomach inside the clam.

2. Clam --
   Slurping its food through its siphon.

3. Amphipod --
   Chewing detritus on the beach.

4. Barnacle --
   Catching plankton with feathery feet.

5. Anemone --
   Grabbing food with its tentacles.

6. Limpet --
   Scraping up plants with its jagged tongue.

7. Crab --
   Slicing up meat with its pinchers.

Three Little Salmon

1. Down in the meadow in an itty bitty pool
Swam three little salmon where the water was cool.
"Swim" said a voice, "swim if you can"
And they swam and they swam right over the dam.

Boomp boomp ditum dattum wattum choo
Boomp boomp ditum dattum wattum choo
Boomp boomp ditum dattum wattum choo
They swam and they swam right over the dam.

2. Down in the estuary they got fat
Eating copepods and amphipods and things like that.
Then the three little salmon went off on a spree
And they swam and they swam right out to the sea.

Boomp boomp ditum dattum wattum choo . . .
They swam and they swam right out to the sea.

3. "Help," cried the salmon, "look at the whales!"
Seals and tuna were hot on their tails.
Then came that voice, it said, at last,
"Go back to the place that you were hatched."

Boomp boomp ditum dattum . . .

4. Swimming up the river came the salmon run.
They couldn't stop for anything, no time for fun.
When they came to the dam they could not stop.
They had to get over the top.

"Jump!" said the voice,"No time for rest."
"Jump!" said the voice and they jumped their best.
Some had to try three or four times.
Then they swam and they swam right over the dam.

Boomp boomp ditum dattum . . .

If you're not familiar with this tune, call Padilla Bay (206) 428-1558.
We'll sing over the phone!

The Eelgrass Song

(Food chain version)
To the tune of "The Green Grass Grew all Around,"
a call and response song

Oh Padilla is a bay.
Oh Padilla is a bay.
And it is an estuary.
And it is an estuary.
'Bout the prettiest estuary
'Bout the prettiest estuary
That you ever did see
That you ever did see

Oh, Padilla is a bay and it is an estuary,
and the eelgrass grows all around, all around,
and the eelgrass grows all around.

Now in that bay,
There is an eagle.
'Bout the prettiest eagle
That you ever did see.

Oh the eagle's in the bay and the bay's an estuary,
and the eelgrass grows all around, all around,
and the eelgrass grows all around.

Now in that eagle, there is a duck . . .

Now in that duck, there is a crab . . .

Now in that crab, there is a copepod . . .

Now in that copepod, there is detritus . . .

and the eelgrass grows all around, all around,
and the eelgrass grows all around.

The Eelgrass Song

(Botanical version)

Oh Padilla is a bay.
Oh Padilla is a bay.
And it is an estuary.
And it is an estuary.
'Bout the prettiest estuary
'Bout the prettiest estuary
That you ever did see
That you ever did see

Oh, Padilla is a bay and it is an estuary,
and the eelgrass grows all around, all around,
and the eelgrass grows all around.

Now in that bay,
Now in that bay,
There was some mud.
There was some mud.
'Bout the prettiest mud
'Bout the prettiest mud
That you ever did see.
That you ever did see.

Oh, the mud was in the bay and the bay's an estuary,
and the eelgrass grows all around, all around,
and the eelgrass grows all around.

Now in that mud, there was a root.

Now on that root, there was a blade . . .

Now on that blade, there was a flower . . .

Now on that flower, there was an amphipod . . .
and the eelgrass grows all around, all around,
and the eelgrass grows all around

Did you ever see a barnacle?

(Tune -- "Did You Ever See a Lassie")

Did you ever see a barnacle, a barnacle, a barnacle?
Did you ever see a barnacle go this way and that?
Go this way and that way
Go this way and that way
Did you ever see a barnacle go this way and that?

2. Jellyfish
3. Some eelgrass
4. Heron
5. Eagle
6. Crab
7. Anemone
8. Pipefish
9. Worm
10. . . .

This is a good action song!

Roll On, Columbia

by Woody Guthrie

Green Douglas firs where the waters cut through
Down her wild mountains and canyons she flew
Canadian Northwest to the ocean so blue
Roll on, Columbia, roll on.

Roll on, Columbia, roll on
Roll on, Columbia, roll on
Your power is turning our darkness to dawn
So roll on, Columbia, roll on.

Other great rivers add power to you
Yakima, Snake and the Klickitat too
Sandy Willamette and Hood River too
It's roll on, Columbia, roll on.

Try adapting this song to your local river. Let the kids make up verses. (Roll on, Skagit, roll on . . .)

Post-trip

If You're a Crab and You Know It

(Tune: "If You're Happy and You Know It")

If you're a **crab** and you know it, walk sideways.
If you're a crab and you know it, walk sideways.
If you're a crab and you know it, then your walk will surely show it.
If you're a crab and you know it, walk sideways.

If you're a **seastar** and you know it, stretch your arms.
If you're a seastar and you know it, stretch your arms.
If you're a seastar and you know it, then your arms will surely show it
If you're a seastar and you know it, stretch your arms.

If you're a **jellyfish** and you know it, float around.
If you're a jellyfish and you know it, float around.
If you're a jellyfish and you know it, then your shape will surely show it.
If you're a jellyfish and you know it, float around.

If you're a **clam** and you know it, close your shells.
If you're a clam and you know it, close your shells
If you're a clam and you know it, then your shells will surely show it.
If you're a clam and you know it, close your shells.

If you're a **worm** and you know it burrow down.
If you're a worm and you know it burrow down.
If you're a worm and you know it, then your squirms will surely show it.
If you're a worm and you know it burrow down.

Now add your own verses . . .

Post-trip

More Ideas

- Make a list of words describing an estuary. Turn them into a poem.
- Write a story from the point of view of an animal living in an estuary.
- Write a letter to Padilla Bay on how you felt about your trip and what you experienced there. You may want to give students questions to answer in their letters. For example: Why are estuaries important? What can you do to help estuaries?
- Write a riddle about a "sea treasure." Have others guess.
- Make chimes from driftwood and clamshells.
- Make Japanese fish prints (Gyotaku). Latex house paint washes up easily and is permanent on T-shirts or cloth when dry.
- Create a mural of an estuary and have each student add an animal or plant. Fish prints, shell rubbings and tissue paper eelgrass make interesting additions.
- Color egg carton "barnacles." Use 2" pieces of pipecleaners for the feathery feet. The feet can be pulled in as the tide goes out.
- Make a list of the foods we eat that come from an estuary.
- Talk about seaweed and its nutritional value. Investigate what foods are made with algin and carrageenan, derivatives of seaweeds.
- Visit an oriental food store or talk to a Japanese chef. Taste some seaweed products.
- Play fish net tag. Three people hold hands to form the net. Everyone else is a fish. When the net tags a fish, the fish joins on to become part of the net. Continue until everyone is in the net. This is a game without losers!
- Play charades: Have students act out how an animal moves or eats for the rest of the class to guess. Have a group of students act out an estuary food chain.

Wait for me
Devin

Resources

Children's Books* ..... p. 83
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Curricula* ..... p. 85
Places ..... p. 86
Organizations ..... p. 87
Road Map ..... p. 88

*These materials are available for review at Padilla Bay.

Children's Books

Carle, Eric, ***A House for Hermit Crab***, Saxonville, Massachusetts: Picture Book Studio, Ltd., 1987.
- Colorfully illustrated story of a hermit decorating its shell only to outgrow it and move on.

Cole, Sheila, ***When the Tide is Low***, New York: Lothrop, Lee & Shepard Books, 1985.
- A lyrical story of waiting for the tide. A good introduction to tides and the seashore.

Cone, Molly, ***Come Back Salmon***, San Francisco: Sierra Club books for Children, 1992.
- The exciting account of elementary school students in Everett, WA who clean up their stream and restore a historical salmon run.

Dean, Jana, ***Wetland Tales; A Collection of Stories for Wetland Education***, Washington State Department of Ecology Publication # 92-17,
- Delightful stories from the oral traditions of many cultures.

Glaser, Michael, ***Does Anyone Know Where a Hermit Crab Goes?***, Massachusetts: Knickerbocker Publishing company, 1983.
- A charmingly simple poem about the adventures of a hermit crab.

Holling, Holling Clancy, ***Pagoo***, Boston: Houghton Mifflin Company, 1957.
- A classic tale about the often dramatic encounters of a young hermit crab, full of "lessons."

James, Simon, ***Sally and the Limpet***, New York: Macmillan Publishing Co., 1990.
- A comical tale with a conservation message.

Lionni, Leo, ***Fish is Fish***, New York: Pantheon, 1970.
- A wonderful story about fish, easily understood by preschoolers.

Siberell, Anne, ***Whale in the Sky***, New York: E.P. Dutton, 1982.
- A Native American story about the natural world.

Waterton, Betty, ***A Salmon for Simon***, Vancouver, B.C.: Douglas & McIntyre, 1978.
- How a small boy saves the life of the salmon he intended to catch.

Resources

Magazines

"Clearing: Nature and Learning in the Pacific Northwest"
Environmental Education Project
PO Box 751
Portland, OR 98207
- A valuable network of people and places, information on happenings, ideas, activities and resources for teaching about the environment.

"Naturescope," "Our Big Backyard," "Ranger Rick"
National Wildlife Federation
1412 Sixteenth Street, NW
Washington, D.C. 20036-3366
- Wildlife education curriculum and outstanding childdrens magazines

Reference Books

Berrill, J.J. and Jacquelyn, ***1001 Questions Answered About the Seashore***, New Your: Dover Publications, 1957.

Coulombe, Deborah, ***The Seaside Naturalist***, New York: Prentice-Hall, Inc., 1984.

Flora, Charles and Eugene Fairbanks, M.D., ***The Sound and the Sea***, Bellingham, WA: Western Washington Press, 1983.

Kozloff, Eugene, ***Seashore Life of the Northern Pacific Coast***, Seattle: University of Washington Press, 1983.

Snively, Gloria, ***Exploring the Seashore of British Columbia, Washington and Oregon***, Vancouver, B.C.: Gordon Soules Book Publishers Ltd., 1978.

Yates, Steve, ***Marine Wildlife***, Connecticut: The Glove Pequot Press, 1988.

Zim, Herbert and Lester Ingle, ***Seashores: A Guide to Animals and Plants Along Beaches***, New York: Golden Guide Press, 1955.

Curricula

Alaska Sea Week Curriculum Series
Alaska Sea Grant College Program
University of Alaska
Fairbanks, AK 90701
- A wonderful series of interdisciplinary beach and classroom activities in all aspects of marine studies, for elementary grades; award winner

Aquatic Project Wild
Larry Broder, Project Wild Coordinator
Washington State Department of Wildlife
16018 Mill Creek
Mill Creek, WA 98012
(206) 775-1311
- A compilation of diverse, interdisciplinary activities for all ages. Available through teacher workshops only.

ORCA: Ocean Related Curriculum Activities
Marine Education Project
Pacific Science Center
200 Second Avenue N
Seattle, WA 98109
- "High Tide, Low Tide" and "Life Cycle of the Salmon" for grades 3-4 can be adapted for lower grades; excellent information and activities.

Project For Sea
Marine Science Center
PO Box 2079
Poulsbo, WA 98370
- Extensive and exemplary curriculum for grades 2 - 4 (older available as well); content includes animal and plant identifiocation and ecological concepts; award winner.

The Seattle Aquarium Curriculum
The Seattle Aquarium
Pier 59, Waterfront Park
Seattle, WA 98101
- Curriculum for all grades, preschool as well, to supplement visits to the aquarium; teacher information, pre- and post-visit activities included.

Resources

Places

Bellingham Maritime Heritage Center
1600 "C" Street
Bellingham, WA 98225
(206) 676-6806
- Salmon hatchery; education programs available.

Point Defiance Zoo & Aquarium
5400 North Pearl Street
Tacoma, WA 98407
(206) 591-5335
- An exemplary zoo with aquariums; education programs available.

Port Townsend Marine Science Center
Fort Worden State Park
Port Townsend, WA 98368
(206) 385-5582
- Touch tanks; education programs available.

Poulsbo Marine Science Center
PO Box 2079
Poulsbo, WA 98370
(206) 779-5549
- Marine center with comprehensive school programs.

The Seattle Aquarium
Pier 59, Waterfront Park
Seattle, WA 98101
(206) 625-4358
- Extensive aquariums and exhibits; school programs.

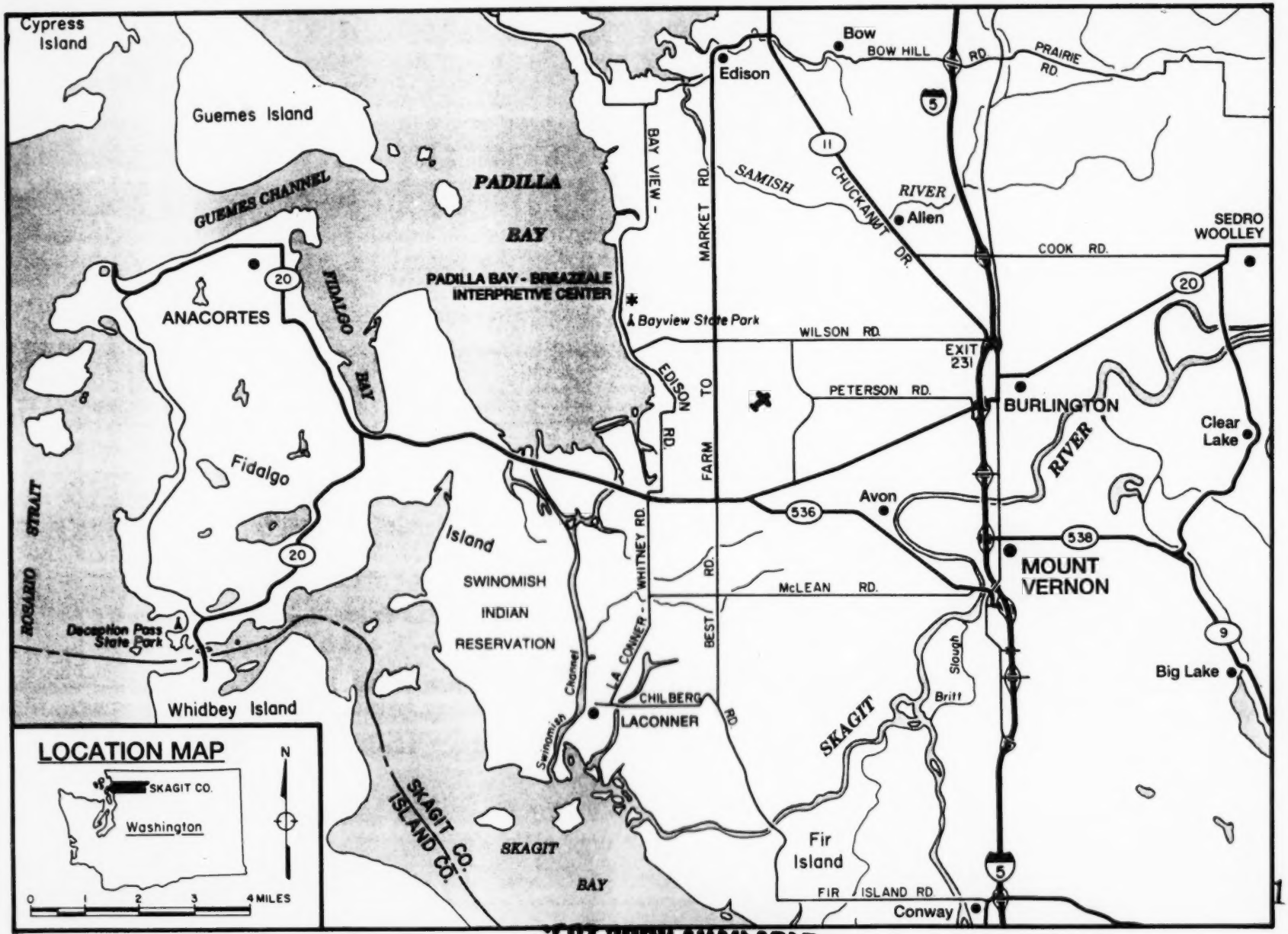
The Whale Museum
PO Box 945
Friday Harbor, WA 98250
(206) 378-4710
- Museum and research dedicated to whales; elementary curriculum.

Washington State Office of Environmental Education
2800 NE 200th
Seattle, WA 98155
(206) 365-3893
- A resource center; offers curriculum materials, films, videos, workshops.

Organizations

Northwest Association of Marine Educators (NAME)
Norie Dimeo-Ediger (Sec./Tres.)
15630 NW Davidson Road
Banks, OR 97106
- An active organization of educators and enthusiasts interested in marine and aquatic eduction in Alaska, British Columbia, Washington, and Oregon. NAME is the regional chapter of the National Marine Education Association (NMEA).

Environmental Education Association of Washington (EEAW)
PO Box 4122
Bellingham, WA 98227
- Promotes environmental education in Washington; sponsers annual conference.



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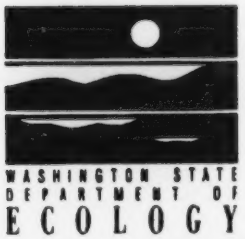

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